DOCUMENT RESUME

ED 384 336 IR 017 135

AUTHOR Hope, Warren C.
TITLE Microcomputer Technology: Its impact on Teachers in an Elementary School.
PUB DATE 95
NOTE 219p.; Ed.D. Dissertation, Florida State University.
PUB TYPE Dissertations/Theses - Doctoral Dissertations (041)

EDRS PRICE MF01/PC09 Plus Postage.
DESCRIPTORS Computer Literacy; Computer Uses in Education; *Educational Technology; Elementary Education; Elementary School Teachers; *Influences; *Microcomputers; Program Implementation; Teacher Attitudes; *Use Studies; Workstations
IDENTIFIERS Marion County Public Schools FL

ABSTRACT

The purpose of this study was to examine the initiation and implementation of microcomputer technology in the educational environment of N.H. Jones Elementary School (Ocala, Florida) and to assess its impact on teachers. Microcomputer technology was configured as a teacher workstation. A conceptual framework was developed to promote microcomputer technology and to monitor and interpret the phenomenon. Elements of the framework were five guidelines of the Innovation-Focused strategy, interventions of the Change Facilitator strategy, and the Concerns-Based Adoption Model (CBAM). Five questions which directed the research were: (1) What concerns did teachers have about microcomputer technology? (2) Were there factors in the school environment that promoted the diffusion and use of microcomputer technology by teachers? (3) Were there perceived barriers that impeded teacher acceptance and use? (4) What levels of use did teachers attain using the innovation microcomputer technology? and (5) What teacher-related outcomes were attributed to using microcomputer technology? Results showed that teachers had Self and Task concerns at the beginning of the study, changing to Impact, Consequences, and Refocusing concerns as their involvement with the technology increased. Results revealed that teachers clustered in Mechanical and Routine user levels. By the end of the study, 80% of teachers had reached the Routine Level of Use. Recommendations for future research include configuring microcomputer technology beyond a teacher workstation, replication of the study using the change model presented and identifying long-term impact of microcomputer technology on teachers. Fourteen tables and 14 figures illustrate study findings. Appendices include: Stages of Concern Technical Information; N.H. Jones Elementary Change Strategy; Level of Use Protocol; Chronology of Events; Microcomputer Workstation Configuration; Stages of Concern Interpretations; and Teachers' Stage of Concern Mean Percentile Scores for Instructional Technology, May 1993, September 1993, and May 1994. Contains 87 references. (Author/MAS)

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THE FLORIDA STATE UNIVERSITY

COLLEGE OF EDUCATION

MICROCOMPUTER TECHNOLOGY: ITS IMPACT ON TEACHERS IN AN ELEMENTARY SCHOOL

By

WARREN C. HOPE

A Dissertation submitted to the
Department of Educational Leadership
in partial fulfillment of the
requirements for the degree of
Doctor of Education

Degree Awarded:
Spring Semester, 1995

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ACKNOWLEDGEMENTS

Thanks be to God, who gives us the victory through our Lord Jesus Christ. To my wife Cynthia who endured days and nights of my absence while I pursued this goal yet found patience and love. And to my children Warren Jr., Kamaria, Arisha, and Mariama who felt it not robbery that I spend so much time, energy, and resources on something else.

I am indebted and grateful to the faculty of N. H. Jones Elementary School. I thank them for embracing microcomputer technology and consenting to be participants in this study. Thanks to Mrs. Debra Richardson for typing and typing again many portions of the manuscript.

I extend thanks to members of my dissertation committee, Dr. Judith Irvin, Dr. Charles Wolfgang, and Dr. David Leslie for their feedback, advice, and support of this research effort. Thanks also to Dr. David Lidstrom for sharing his CBAM expertise. And to my major professor, Dr. Robert G. Stakenas, whom I count as mentor and friend; thank you for the willingness to be involved with me in this process and the manner in which you guided me to this end.

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ABSTRACT

The purpose of this study was to examine the initiation and implementation of microcomputer technology in the educational environment of N. H. Jones Elementary School and to assess its impact on teachers. Microcomputer technology was configured as a teacher workstation.

A conceptual framework was developed to promote microcomputer technology and to monitor and interpret the phenomenon. Elements of the framework were five guidelines of the Innovation-Focused strategy (Fullan, 1985), interventions of the Change Facilitator strategy (Hall & Hord, 1984) and the Concerns-Based Adoption Model (CBAM) (Hord, Rutherford, Huling-Austin & Hall, 1987).

Five research questions provided direction for the inquiry. The questions were: 1. What concerns did teachers have about microcomputer technology? 2. Were there factors in the school environment that promoted the diffusion and use of microcomputer technology by teachers? 3. Were there perceived barriers that impeded acceptance and use of microcomputer technology by teachers? 4. What levels of use

did teachers attain using the innovation microcomputer technology? 5. What teacher-related outcomes are attributed to using microcomputer technology?

Teachers' concerns were identified with the Stages of Concern instrument of the CBAM. Results showed that teachers had Self and Task concerns at the beginning of the study. As teachers increased their involvement with microcomputer technology their concerns shifted toward the Impact concerns, Consequences, Collaboration and Refocusing. Teachers' levels of use of microcomputer technology was assessed with the Level of Use instrument. Results revealed that teachers clustered in Mechanical and Routine user levels. By the end of the study 80% of teachers had reached the Routine Level of Use.

Study Conclusions were: 1. Fear of technology can be alleviated with an implementation strategy that empowers teachers and accepts and works within their point of view, 2. Complexity of an innovation affected the rate at which teachers mastered and used the innovation, and 3. Configuring the innovation into its component parts facilitated successful implementation and alerted the change facilitator to technical assistance needs.

Recommendations for future research include configuring

microcomputer technology beyond a teacher workstation, replication of the study using the change model presented and identifying long term impact of microcomputer technology on teachers.

CHAPTER 1

INTRODUCTION

A focal point in education in recent years has been on school improvement and how it is to be realized. During the past decade technology has emerged as a viable option in the delivery of educational services to students. Many electronic devices, the microcomputer leading the way, have cast a new light on the teaching and learning process. What eventual role microcomputer technology will have in school settings and the precise impact that technology will have on education has not manifested itself. Nevertheless, the whole nation is captivated by technological images and what those images hold as promise for an educational system that has been described as needing improvement (Timar & Kirp, 1989; Willis, 1984).

In the state of Florida, school improvement is being conceptualized in terms of accountability and instructional technology. Former Florida Commissioner of Education, Betty Castor remarked that technology is crucial to school improvement (Shapley, 1992). The Florida Commission on

Education Reform and Accountability has proclaimed that for the state of Florida, the availability and appropriate use of technology are keys to the success of the education reform movement (Roland & Dilger, 1994).

That U. S. students are not achieving in math and science as well as their counterparts in other countries around the world is no small matter to the stakeholders of the nation's schools (Kerr, 1989; Wyatt, 1985). The business community has vocalized its disappointment with the students who graduate from schools (Funk & Brown, 1994; Secretary's Commission on Achieving Necessary Skills, 1991) and there are numerous reports of student disengagement from the content of instruction and boredom in the classrooms around the country (Collins, 1991; Bailey & Lumley, 1991).

The integration of microcomputer technology in teaching and learning is viewed by many as the vehicle that can quiet critics and improve student learning outcomes. Yet, the appropriate use of microcomputer technology in the classroom and how it affects the teaching-learning environment and those who are in the environment is a matter that is still in the process of being developed.

The background for this study is related to at least

three specific events. The first is the A Nation At Risk report which has since its release in 1983 been, like Paul Revere's ride, sounding the alarm that the educational system of the United States is in deterioration. The second is the advent of the microcomputer and its capability as a teaching and learning tool. And the third is restructuring of education in the state of Florida and its specific recognition of computer technologies as a source of school improvement.

Change is an important feature of the restructuring efforts that are taking place at the school level in the attempt to improve education. The process involves the diffusion of a specific innovation in schools, the acceptance of the innovation by teachers, and the delineation of appropriate strategies and techniques for implementing and integrating the innovation into educational practice.

This study recounts how microcomputer technology was diffused and adopted in a traditional elementary school setting by the school's faculty. Beginning in the summer of 1992, an Instructional Technology Planning Committee (ITPC) composed of the school principal, a special area teacher, and teachers from the third, fourth, and fifth grade met and

began formulating a plan for the integration of microcomputer technology in N. H. Jones Elementary School. The need for a plan to incorporate technology in the school emerged out of the midst of a number of catalysts in the school environment. Foremost among these was the need for the school to improve its image and for teachers to develop new skills to keep pace with changes in the practice of education.

The committees' attitude toward technology corresponded with views held by Senese (1984) who stated that technology is a viable approach to the delivery of educational services and through technology teachers can become more effective in their teaching practices and students can become more effective learners. Gillman (1989) concluded that instructional technology could promote student achievement and when it is appropriately applied in schools, it has the power to enhance the instructional program, to improve student academic performance, and provide effective and efficient classroom, school, and administrative systems.

Teachers' use of technology was also viewed as a way to increase teacher productivity and simplify many of the repetitive tasks that teachers carry out. Kearsley, Hunter, and Furlong (1991) related that technology is helping

teachers develop new ways to manage their classrooms. Teachers often complain about the administrative aspects of teaching which include making up and scoring tests, keeping track of books, keeping grades and attendance, communicating with parents, and completing paperwork on students. Microcomputers can handle these administrative duties efficiently and allow teachers time to be more productive in other areas. The committee's perspective on technology also agreed with Long (1985) who noted that use of microcomputer systems made some teachers feel more professional about what they were doing and resulted in a more positive attitude and higher morale.

Hence, the faculty and staff of N. H. Jones Elementary set a course to adopt and use microcomputer technology. Teachers were willing to improve their professional skills by virtue of availability and training to use computers and other technology devices and then use acquired skills and knowledge to enhance learning opportunities for students. Armed with the understanding that funds were available to acquire computers and other instructional technologies through the Chapter 1 schoolwide project, a commitment began to develop that led to a two year experience with microcomputer technology.

Over the course of three years, the duration of the Chapter 1 project, a sizable inventory of microcomputer technology was acquired. This inventory included ten Macintosh microcomputers with printers that formed the foundation of the school's microcomputer technology efforts and one AS 2000 multimedia system housed in the media center and also purchased through Chapter 1 funds.

These Chapter 1 technology purchases augmented microcomputer technology purchases using regular school funds. The items purchased included four IBM PS/2 50Z microcomputers with printers and Gradebook Plus software and two Macintosh LC II systems sponsored by the school district. Software purchased from Chapter 1 monies included WordPerfect and Microsoft Works. Computer carts were acquired through the school budget.

Purpose and Significance of Study

The purpose of this study was to examine the initiation and implementation of microcomputer technology in the educational environment of N. H. Jones Elementary School and to assess its impact on teachers. The study also focused on the change process that was involved in adopting microcomputer technology.

The appropriate use of microcomputer technology by

teachers in the classroom, how microcomputer technology affects the teaching and learning environment, and the desired learning outcomes for students using microcomputer technology are questions needing continued research. The utility of microcomputers and the procedures suitable in assisting teachers with job related tasks need clarification also. The significance of this study is that it will contribute to the growing knowledge base of the impact of microcomputer technology on teachers, the instructional environment, and the school. This study will also extend the understanding of change as a process and provide insight into the diffusion of microcomputer technology in an educational setting.

Study Design and Methods

The purpose of the study was accomplished through a single site case study using multiple sources of evidence, (i. e., direct observation, participant observation, interviews, archival records, and physical artifacts) and pre-and posttests on a single unit of analysis. The unit of analysis was 18 classroom teachers. The site for the case study was N. H. Jones Elementary School in Ocala Florida.

For the pre-and posttests, the Stages of Concern Questionnaire and the Levels of Use interview of the

Concerns-Based Adoption Model were administered to teachers once during the first semester of the 1993-1994 school year and once during the second semester of the 1993-1994 school year. These instruments provided means for monitoring teachers' concerns about microcomputer technology and teachers' progress in using this innovation.

Five questions were defined to give focus to the inquiry for this research study. Those questions with the method of data collection are presented in Table 1.

Participants

The participants in this study were members of the instructional staff of N. H. Jones Elementary School (hereafter referred to as NHJ) in Ocala, Florida. The educators at this school site embraced microcomputer technology to make a difference in their professional lives and impact the effectiveness of the school's educational program.

The Innovation

In the first year, August 1992 - May 1993, the innovation was initially conceptualized as instructional technology consisting of different kinds of teaching devices. However, the innovation was redefined by the ITPC during a meeting in March 1992 as a microcomputer

Table 1

Research Questions and Data Collection Method

Research Questions	Data Collection Method
1. What concerns do teachers have related to using microcomputer technology?	Concerns-Based Adoption Model Stages of Concern instrument
2. Were there factors in the school environment (e. g. availability of hardware and software, training opportunities, assistance, and incentives) that promoted the diffusion and use of microcomputer technology by teachers?	Teacher interviews Teacher questionnaire
3. Were there perceived barriers that impeded teacher acceptance and use of microcomputer technology?	Participant observation Direct observation Teacher interviews
4. What levels of use did teachers attain with the innovation of microcomputer technology?	Concerns-Based Adoption Model Level of Use interviews
5. What teacher-related outcomes (e.g., personal productivity, information management, change in practice, impact on self) are attributed to using microcomputer technology?	Concerns-Based Adoption Model Level of Use interviews Teacher lesson plans Student grade reports

workstation wherein teachers used the microcomputer and specific software to word process, manage information, write

lesson plans, maintain student grades, and keep records thereby leading to enhanced professional skills. This configuration of microcomputer, printer, and software was referred to as microcomputer technology at NHJ. For clarity, the term instructional technology will be used in reference to events in the 1992-1993 school year and microcomputer technology and microcomputer workstation will be used interchangeably with events occurring in the 1993-1994 school year.

Instruments

Much of the data collected for this study was through two of the three dimensions of the Concerns-Based Adoption Model (Hall, George & Rutherford, 1986) a tool for introducing change and monitoring its implementation. The first dimension, Stages of Concern was ten years in the making and validated over a period of three years (Hall et al., 1986). The Stages of Concern Questionnaire (SOCQ) focuses on the concerns of individuals involved in change. The Concerns dimension consists of seven stages and has several strengths. One, the accuracy of assessment has been developed through extensive research. Two, the questionnaire provides data for an individual profile on the specified concerns. And three, the Concerns questionnaire is

versatile, in that it can be administered several times during a year. The Stages of Concern are Awareness, Informational, Personal, Management, Consequence, Collaboration, and Refocusing (see Appendix A for technical information regarding Stages of Concern).

The Levels of Use dimension (Loucks, Newlove, & Hall, 1975) assesses the amount of change in practice by individuals using a specific innovation. The validity of the Level of Use dimension was established through a special study conducted using field researchers and trained interviewers. The field researchers rated the level of use of the innovation by teachers and a comparison was made of the results with the interviewers. The field workers observations of teachers' level of use and the interviewers obtained level of use correlated at .98 (Hord et al., 1987). These two dimensions of the CBAM were used to collect data, monitor the change process and teacher use of microcomputer technology at NHJ.

Procedures

This study was conducted over a two year period and assessed the impact of microcomputer technology on 18 classroom teachers at NHJ. In this study, the researcher was the change facilitator. In addition to being the change

facilitator, the researcher was also the principal of the school. In the role of change facilitator, the researcher employed a change strategy that evolved from combining two change strategies. Those strategies were the Innovation-Focused strategy enumerated by Fullan (1985) and the Change Facilitator strategy developed by Hall and Hord (1984). This hybrid model was used to facilitate introduction of the innovation and to monitor teacher use of the innovation (see Appendix B for N. H. Jones Elementary Change Strategy).

The focus of the study was to examine the impact of microcomputer technology on classroom teachers at NHJ. Specifically, impact on teachers was monitored through the Concerns-Based Adoption Model instruments and data gathered through participant observation, direct observation, and interview. Results of the SOCQ yielded information that alerted the change facilitator to concerns teachers had about microcomputer technology and the area of assistance that each classroom teacher needed in becoming a user of microcomputer technology.

Another instrument used to assess the impact of microcomputer technology on classroom teachers was the Levels of Use (LoU) interview. The LoU is a focused

interview based on a set of questions used in a branching format (see Appendix C for LoU protocol). The branching format was used because individually, teachers were at different levels in their use of microcomputer technology. Some questions in the LoU interview protocol were not applicable to all teachers given their level of use of microcomputer technology.

The researcher collected data through participant observation from classroom teachers, and informal interviews were conducted with classroom teachers during the 1993-1994 school year to assess the impact of microcomputer technology on them.

Chronology of Events

The events of this case study cover a period of more than two years (see Appendix D, Table 15 for Chronology of Events). The table presents a longitudinal perspective of these events and the time frame in which they occurred. The table identifies prominent events highlighting meetings, hardware and software acquisitions, training activities for teachers, data collection points, and other key events.

Researcher Bias

This study investigated the impact of introducing microcomputer technology on teachers at NHJ. The

introduction of the innovation required planning and implementing a change process that participants experienced. The researcher (also principal of NHJ) was a prominent part of the change process as well as a participant observer. The researcher acted in the capacity of change facilitator. As a change facilitator, the researcher provided resources such as hardware, software, guidelines, release time, and technical assistance to the participants. And, the researcher monitored all stages of the change process through data collection and provided feedback to teachers in their use of microcomputer technology. The researcher consulted with teachers to determine their needs and provided training opportunities, encouragement, supplies, and other assistance.

The reliance upon the researcher as the tool for collecting data has been questioned. Jorgenson (1989), however, wrote that the methodology of participant observation, an important data collection technique of case studies, rejected this viewpoint. He stated that the researcher needs to consider his or her values along with other participants because these values hold implications for truth findings. In support of Jorgenson's assertion, Fetterman (1989, p. 15) wrote that, "People act on their

individual perceptions, and those actions have real consequences--thus the subjective reality each individual sees is no less real than an objectively defined and measured reality."

All research is subject to appropriate standards of reliability and validity. The degree to which these elements are accounted for in the research design will ultimately determine the study's findings. For this study, reliability and validity were maintained by using reliable instruments and triangulation. Triangulation is recognized as a strategy that can improve the validity of research findings by using multiple sources of data. The sources of data used in this study were direct observation, participant observation, interviews, archival records, and physical artifacts. Any of these sources of evidence can be the sole basis for a study (Yin, 1989). In this study, the form of these sources of evidence are found in field notes--direct observation, ITPC meetings--participant observation, focused and open-ended interviews, survey data--archival records, and computer printouts--physical artifacts.

Construct validity of the study was established through a "chain of evidence" (Yin, 1989, p. 42). The chronology of this study will present such a chain linking the research

questions, the data collected, and study conclusions. This linkage will be demonstrated in convergent data from direct observation, documents, interviews, and reliable instruments. Interview statements from respondents were verified by direct observation of the researcher. Participants ability to produce documents (e.g., lessons plans, gradebook printouts) were correlated with data collected with CBAM research instruments. To control for researcher bias, the manuscript was subjected to member checks allowing study participants to critique accuracy of information obtained from interviews, meetings, and researcher observations. Four teachers read chapters three, four, and five of the manuscript. These teachers were at NHJ from beginning to end of the study. The teachers commented positively on the study and did not report any discrepancies in the manuscript.

Dr. R. G. Stakenas, the dissertation committee members, and Dr. David Lidstrom, a CBAM specialist were peer examiners for this research study and were consulted to further establish the credibility of the study and to insure validity and reliability of the results.

CHAPTER 2

CONCEPTUAL FRAMEWORK

The conceptual framework is a synthesis of components of the Innovation-Focused strategy (Fullan, 1985), the Change Facilitator strategy (Hall & Hord, 1984) and the Concerns-Based Adoption Model (Hord et al., 1987). The guidelines of the Innovation-Focused strategy, the game plan components of the Change Facilitator strategy, and the dimensions of the Concerns-Based Adoption Model, were combined to yield an overall conceptual framework to interpret the phenomenon being studied.

The first change strategy and key element of the conceptual framework was the Innovation-Focused strategy that Fullan (1985) developed out of the literature. This strategy is advanced through eight particular guidelines. This study used five of the eight guidelines (see Table 2 for Innovation-Focused strategy guidelines).

The second change strategy used in this study was the Change Facilitator strategy. This strategy enabled the researcher to plan for strategic interventions to promote

Table 2

Innovation-Focused and Change Facilitator Strategies

Guidelines and Game Plan Components
1. Develop a Plan
2. Clarify and develop the role of central staff
3. Select innovations and schools
4. Clarify and develop the role of principals and criteria for school-based processes
5. Stress staff development and technical assistance
GPC 1:
Making Decisions
Planning
Preparing
Seeking or providing materials
Providing equipment
GPC 2:
Developing positive attitudes
Holding workshops
Modeling/demonstrating innovation use
Observing innovation use
Providing feedback on innovation use
GPC 3:
Encouraging people on a one-to-one basis
Promoting innovation use among small groups
Assisting individuals in solving problems
Providing personalized technical assistance
Holding brief conversations and applauding progress
Reinforcing individuals attempts to change
Celebrating small/large success
GPC 4:
Gathering information collecting data
assessing innovation knowledge or skills informally
assessing innovation use or concerns informally
providing feedback on information collected
analyzing/processing data
interpreting information
reporting/sharing data on outcome

the innovation and manage more efficiently and effectively the required interventions. This strategy was used because it specified what the change facilitator could do to promote innovation adoption and support the change process.

The Concerns-Based Adoption Model (CBAM) was an integral part of the conceptual framework for this study. The CBAM has three dimensions that characterize the change process as experienced by individual users. These dimensions are Innovation Configuration, Stages of Concern, and Levels of Use. Each dimension is an independent concept. The Innovation Configuration dimension is best described as a way to define the innovation by identifying its characteristics which can then be used to check the levels of use by those involved with the innovation. The Stages of Concern, and Levels of Use dimensions provided the means for interpreting the impact of microcomputer technology on teachers at NHJ.

Figure 1 presents a schematic of the key elements of the conceptual framework of this study. The change facilitator holds a prominent position in the schematic in relation to other elements. The change facilitator utilizes the resource system available to initiate the innovation. The change facilitator also employs

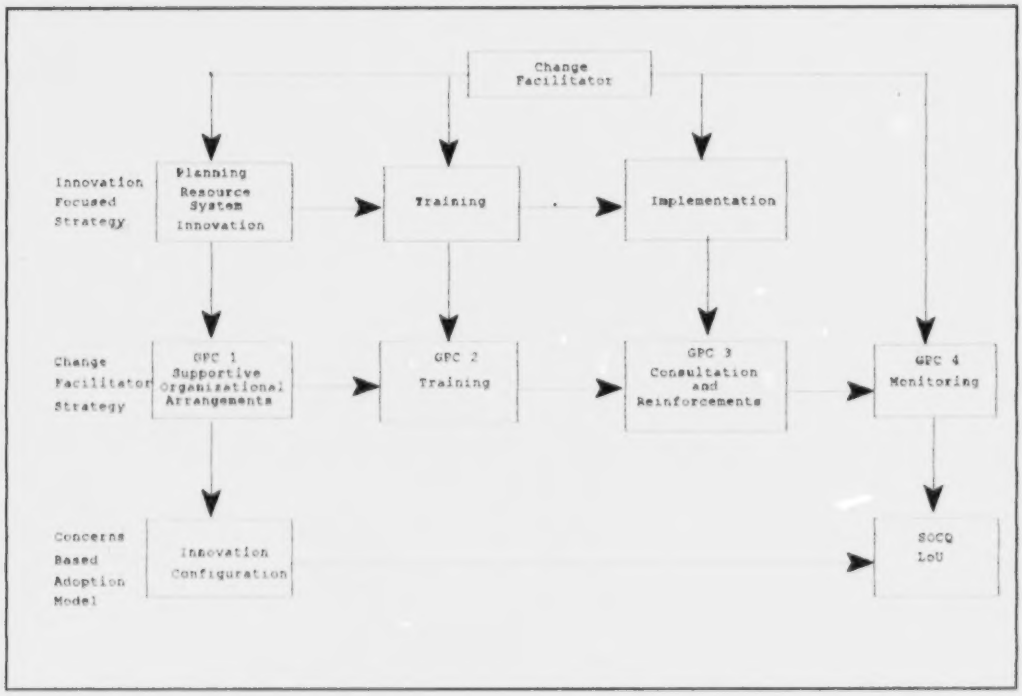

Figure 1. Schematic of key elements of the conceptual framework

the guidelines of the Innovation-Focused strategy and the interventions of the change facilitator strategy to promote use of the innovation by teachers. And the change facilitator uses the research tools of the CBAM to monitor teacher concerns and to collect data reflecting teachers' level of use of the innovation.

Innovation-Focused Strategy

The Innovation-Focused strategy is an approach whereby

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a school improvement is identified, adopted, and developed (Fullan, 1985). The strategy is ideally suited to introducing and adopting an innovation in an organization because the three stages initiation, implementation, and institutionalization are encased within it.

The first guideline of the Innovation-Focused strategy is the development of a plan for the implementation of the innovation. This guideline was applied at NHJ through the ITPC formed in the summer of 1992. The committee formulated an instructional technology plan for the school to promote teachers' use of microcomputers and other electronic teaching devices. Paramount in the plan was for teachers to become familiar with using technology and being comfortable with applying the devices' capabilities to the teaching process.

The research literature on implementing microcomputer technology in schools suggests that it proceed from a plan at the specified level. Naron and Estes (1985) asserted that the most effective results are found in districts and schools which develop carefully coordinated plans that address all aspects of technology.

At NHJ, a decision was made to focus on teachers and their use of technology as a productivity tool rather than

to concentrate on computer-assisted instruction (CAI). There were three reasons for this decision. First, there was no conclusive body of research (Campbell, Peck, Horn, & Leigh, 1987; Lappan & Wilson, 1987; Ryan, 1991) that determined that CAI made a significant difference in student achievement. Second, the school principal (researcher) was interested in enhancing the professional skills of the school faculty. And three, NHJ was entering a transition period. The school would perhaps become a magnet school and change its academic focus, and the schoolwide project would be shortlived. There was general agreement among ITPC members that greater impact could be realized with teachers in this period of time than with students.

The second guideline is to clarify and develop the role of the central office staff. NHJ became a Chapter 1 schoolwide project school during the 1991-1992 school year. Funds from the project provided the support needed to proceed with a technology plan. The schoolwide project also clarified the role NHJ wanted the Chapter 1 office to perform in the technology plan. Chapter 1 project funds were used to purchase materials, supplies, equipment and staff development necessary for the school to advance the technology plan.

The next guideline is the selection of the innovation for the school site. The innovation of microcomputer technology was first identified by the faculty and staff of NHJ in 1990-1991 during the original drafting of the Chapter 1 schoolwide project. A need was expressed in that plan for teachers to become aware of and use technology.

The fourth guideline was to clarify and develop the role of the principal and the criteria for school based processes. The role of the principal developed out of the Chapter 1 project goals, the plan developed by the ITPC, and from the principal's interest in microcomputers and staff development goals for faculty and staff. This role at NHJ was further delineated with the need to acquire resources, make decisions concerning instructional technology, support and encourage the change efforts of teachers, and provide technical assistance. The ITPC developed school based processes which included how much and what kind of hardware and software to purchase. The dissemination of the resources, training, and the evaluation of the effort to enhance education through technology also came from the ITPC.

The final guideline stresses the need for staff development and provisions for technical assistance. The

ITPC devoted many hours to discussing staff development needs during the summer of 1992 and the ensuing school year. It was decided that members of the committee would assist other teachers not familiar with technology by providing assistance to those teachers with their selected instructional technology.

Change Facilitator Strategy

Because of the specific interventions outlined in the change facilitator strategy, it was used to a greater extent in implementing the innovation (see Table 2 for Change Facilitator Strategy Interventions). This strategy was also used in monitoring the impact of microcomputer technology on teachers at NHJ. The change facilitator strategy was conducive to carrying an innovation through the implementation stage and was so used in this research study.

The change facilitator strategy is a core of interventions that can be utilized by the change facilitator in the role of change agent. In the change facilitator strategy, the researcher follows a suggested list of actions to promote the innovation in the school environment. These game plan components (GPC) are delineated in six categories. For this study, the change facilitator worked through four game plan components to encourage adoption and

implementation of the innovation.

Game plan component one is identified as developing supportive organizational arrangements. Under this heading are twelve interventions (e. g., developing innovation-related policies, establishing global rules, making decisions, planning, preparing, scheduling, staffing, restructuring roles, seeking or providing materials, providing space, seeking/acquiring funds, and providing equipment). The change facilitator may use these intervention while implementation of the innovation is in process. Of these twelve interventions, the researcher used making decisions, planning, preparing, seeking or providing materials, and providing equipment. These interventions are important in that all were needed in the initiation process. Who will be involved with the innovation, what materials and equipment will be needed for the innovation to be in place, and the actual setting up of innovation components to be used were important at this stage.

Game plan component two is identified as training and includes nine interventions (e. g., developing positive attitudes, increasing knowledge, teaching innovation-related skills, reviewing information, holding workshops, modeling/demonstrating innovation use, observing innovation

use, providing feedback on innovation use, and clarifying innovation misconceptions). The change facilitator may choose whichever interventions are needed during the implementation of the innovation. Of the nine interventions in game plan component two, the change facilitator used developing positive attitudes, holding workshops, modeling/demonstrating innovation use, observing innovation use, and providing feedback on innovation use. The researcher scheduled workshops to train teachers to use the innovation appropriately. Teachers were encouraged verbally and with incentives when small gains in using microcomputer technology were noted. And users of microcomputer technology received positive feedback when hard copy documents were produced using the innovation.

Game plan component three--consultation and reinforcement has twelve interventions (e. g., encouraging people on a one-to-one basis, promoting innovation use among small groups, assisting individuals in solving problems, coaching small groups in innovation use, sharing tips informally, providing personalized technical assistance, holding brief conversations and applauding progress, facilitating small groups in problem solving, providing small "comfort and caring" sessions, reinforcing

individuals' attempts to change, providing practical assistance, and celebrating small successes (or large ones, too). These interventions may be used by the change facilitator to support the change effort. Seven of this component's twelve interventions were used in this study. They were encouraging people on a one-to-one basis, promoting innovation use among small groups, assisting individuals in solving problems, providing personalized technical assistance, holding brief conversations and applauding progress, reinforcing individuals' attempts to change, holding brief conversations and applauding progress, and celebrating small successes.

The change facilitator provided assistance to teachers experiencing difficulty using microcomputer technology. Teachers were rewarded for making incremental progress in the use of microcomputer technology. During faculty meetings individuals were recognized for their accomplishments in using microcomputer technology. And, an innovation success celebration was held on May 11, 1994, for teachers recognizing their success with microcomputer technology.

The fourth game plan component is monitoring and has ten interventions (e. g. gathering information, collecting data, assessing innovation knowledge or skills informally,

assessing innovation use or concerns formally, analyzing/processing data, interpreting information, reporting/sharing data on outcomes, providing feedback on information collected, administering end-of-workshop questionnaires, and conferencing with teachers about progress in innovation use). Of game plan four's ten components, seven components were used in the study. Those components were gathering information, collecting data, assessing innovation knowledge or skills informally, assessing innovation use or concerns formally, analyzing/processing data, interpreting information, reporting/sharing data on outcomes, conferencing with teachers about progress in innovation use, and providing feedback on information collected. Three of game plan four's interventions used were addressed using the Stages of Concern and Level of Use instruments. Those components were gathering information, collecting data, and assessing innovation use or concerns formally. Participant observation, physical artifacts, informal interview, and direct observation provided an additional means to collect data. Data analysis and interpretation followed from the data obtained from the CBAM research instruments. Findings derived from the data analysis were shared with teachers

individually. (Game plan component five, external communication and game plan component six, dissemination of the change facilitator strategy were not used in this study.)

Recognizing the utility of the Innovation-Focused strategy and the Change Facilitator strategy as means to promote microcomputer technology with teachers at NHJ, the researcher synthesized the guidelines of one and the interventions of the other to form a single strategy for this study.

Barriers to Innovation

The purpose of the game plan components of the change facilitator strategy was to identify and overcome barriers to change. The research literature on adoption of innovation and technology was helpful for identifying barriers typically encountered.

Traditionally, educational institutions have a reputation of lethargy when confronted with change. Swindler (1986) observed that an important factor affecting individual's acceptance of technology acquisition and organizational adaptation is the cultural stability he or she experiences. A relatively high level of cultural stability increases the potential for resistance and

prevents individuals from adopting the cultural values, strategies and habits needed to cope with instability due to technology induced organizational change (Swindler, 1986). Culture is the term most often applied to the beliefs and interactions that are exemplified in a particular setting. In schools, the existing culture is highly significant in whether or not change will be accepted and the degree to which proposed change will alter the existing sociocultural context.

The introduction of technology in the school environment has a destabilizing effect on established patterns and methods. Technological transformation affects several different cultural patterns simultaneously (Gattiker, 1990). Gattiker (1990) related that employees will likely view proposed changes with reference to the effect it will have upon them and the resulting consequences. Prior to the technology initiative, the culture of NHJ could be characterized as one where a number teachers came to earn a paycheck. Some teachers didn't really put forth much effort and were not committed to children. Instructional technology would be a destabilizing influence on the status quo.

NHJ did not enjoy the best academic reputation as a

school and had an image problem in the community and district. The faculty received mixed reviews from the school's community related to their competence and professionalism. Many students assigned to go to school at NHJ did not attend because parents requested and received transfers to other district schools. The perception of a weak faculty and academic program was a disadvantage for the introduction of technology. Questions like who would embrace technology, would teachers be willing to change and accept a new innovation, and would teachers actually use technology in the class were unknown variables which posed a difficulty in the introduction of technology.

School traditions do not easily die and educators take pride in status quo and accept change quite cautiously (Payzant, 1989). Two destabilizing events had already occurred at NHJ when the 1991-1992 school year began. One, a new principal had arrived and two, teacher turnover was high with six positions opening prior to the beginning of school.

A major hurdle for teachers to overcome is the fear of doing something different from the way it has always been done. This mindset creates a stumblingblock to progress in schools, especially in relationship to technology. According to teachers on the ITPC, fear comes from a lack of knowledge

and the possibility of loss of self-esteem (field notes, Dos 1, p. 20, VCR recording A, 1992). Galbraith et al. (1990) wrote that some degree of resistance is reasonable to expect relative to an innovation, and this resistance can be attributed to the fear of the unknown.

Another barrier to implementation of technology in the classroom is planning time. Adequate planning time is important in the use of technology. Where would the time to plan the use of technology come from? Given that the teacher has a responsibility already outlined in the course of the day, how would time to learn about another innovation be incorporated?

Butzin (1992) made the following observations about teachers and technology:

1. Today's teachers are overwhelmed,
2. For them to use technology on top of everything else is imposing a burden few teachers are able to bear, and
3. How can teachers find the time to effectively integrate the plethora of software available into the basic subjects?

One teacher mentioned lack of training as a barrier to implementation of instructional technology in the classroom. A prerequisite for a teacher using a device is to first know the device's capabilities. Training requires that someone

know the equipment and software along with having time to provide inservice to teachers. Fulton (1989), Bitter and Yohe (1989), Carlson (1989), Persky (1990) and Barker (1990) all emphasized the importance of training teachers to use technology to gain confidence to exploit its capabilities. A second aspect of training is that teachers will need to have time to complete the training and then have the device available to practice on. This was the concept behind adopting the teacher workstation of which there were only two at NHJ during the 1991-1992 school year.

Concerns-Based Adoption Model

There are several assumptions that undergird CBAM as a conceptual framework. Hall and Hord (1987) delineated these assumptions. The first is understanding the point of view of the participants in the change process. CBAM is client-centered and considers the needs of individuals in relation to the innovation. The main premise of CBAM is that people are the most important factor in the change process. At NHJ the Stages of Concern dimension was used to get a perspective on the point of view of the participants. Teacher results from the SOCQ provided the researcher with information on participants' concerns about the innovation microcomputer technology. The second assumption is the

understanding that change is a process, not an event. Repeatedly, change in education has been represented by the introduction of an innovation and then evaluation. Implementing a program with no substantive monitoring of use and impact on clients represents an inadequate means of fostering change in education. Real change takes place over time and involves operationalizing the new practice in the organization and through people. At NHJ, change was demonstrated in the attitudes and skills of the participants as they learned more about microcomputer technology and expanded their use of that innovation.

Third, it is possible for the facilitator to anticipate much that will occur during a change process. It is important for the change facilitator (CF) to identify the specific ways teachers are using a program so that the change facilitator can make informed decisions about what support and assistance to offer. Using the innovation configuration dimension of CBAM, the change facilitator at NHJ made decisions on innovation use during the implementation phase. The change facilitator interventions list assisted considerably in the anticipation of needs. Fourth, innovations come in all sizes and shapes. At NHJ, the change effort began as the broad conception of

instructional technology and several electronic devices. Prior to the beginning of the 1993-1994 school year, the innovation focus was narrowed to the microcomputer workstation which contained eight component parts. By applying the innovation configuration dimension of CBAM to the microcomputer workstation, the NHJ innovation identified components were: (1) hardware, (2) software, (3) computer carts, (4) training, (5) computer disks, (6) using Gradebook Plus program, (7) using Lesson Planner program, and (8) assistance (see Appendix E for Microcomputer Workstation Configuration).

Fifth, the innovation and its implementation are two sides of the change coin. Innovations are often viewed in terms of books, equipment, supplies, programs or packages; something that is concrete. Implementation, however, falls into the human realm. Meaningful change lies in the human component from which implementation must spring. Innovation cannot proceed apart from implementation. Both however, represent a different point of view of change. Innovation is conceptual while implementation is operational.

Sixth, in order to change something, someone has to change first. This assumption in CBAM was assessed through participant observation and measured using the two data

collection instruments, Stages of Concern and Levels of Use.

Outcome data indicated a beginning point and an endpoint for participants relative to the innovation. And seventh, everyone can be a change facilitator. This aspect of CBAM is vividly expressed in the collaboration that developed over the time frame of this study. As teachers improved in their use of microcomputer technology they also began to share with each other details about the innovation and the progress they were making individually. Focused and Open-ended interviews with teachers revealed that individuals became change facilitators for colleagues as they acquired expertise and overcame isolation to share information and knowledge about microcomputer technology.

The Concerns-Based approach is touted as a unique way to view the change process. Often, innovations have been introduced in workshops with no follow up. In the CBAM model, the change facilitator works in concert with teachers to address present and anticipated needs (Hord et al., 1987).

The Stages of Concern dimension helps the change facilitator understand the effect of the innovation on the user in three areas. The first of these is the area of self. Teacher concerns in this area have to do with wanting to

know more about the innovation and whether it is similar to what they are already doing (Hord et al., 1987). The second area is task. Concerns evidenced in the task area will revolve around teachers' concern for time to use the innovation and how to balance it with the present curriculum. And, the third area is impact, i.e., teacher's concerns about the impact of microcomputer technology on clients. This dimension of CBAM was used to help the facilitator know where each teacher's concerns were and how the facilitator needed to assist that teacher.

The Levels of Use dimension was used to determine the degree to which the innovation was actually practiced. There are eight levels of use identified in the CBAM. The first level 0 is called Nonuse. An individual at Level 0 has little knowledge and no involvement with the innovation. The second, Level I is Orientation. This level is indicative of an individual in the state of acquiring information about the innovation. Third is Level II, Preparation. An individual at this point has made a decision to use the innovation. The fourth Level of Use Level III is referred to as Mechanical use and at this level an individual concentrates on the immediate and day to day use of the innovation. Level III is followed by Level IVA which is the

Routine level. At Level IVA the use of the innovation is stabilized and few changes are made in the innovation's use. The sixth level of use is Level IVB (Refinement). At this point the user manipulates the innovation to provide a greater impact on clients.

The next level of use is Level V (Integration). At this level the user is collaborating with colleagues to provide a collective influence on clients. Level VI (Renewal) is the eighth level of use and is characterized in the user re-evaluating, modifying, or seeking alternatives to the innovation to achieve greater impact upon clients.

In this study the Levels of Use interviews were used to identify the degree or level which teachers were operationalizing microcomputer technology. Levels of use results were reported to teachers individually alerting them to where they were working in relation to LoU categories.

The Concerns-Based Adoption Model is effective in facilitating and monitoring change in an organization. As a model, CBAM provided a usable means of collecting, analyzing, and interpreting research data on the change process.

CHAPTER 3

PRELUDE TO INNOVATION INITIATION, 1991-1992

School Location and Community

N. H. Jones (NHJ) Elementary School is located in west Ocala, Florida, and within the city's African American community. The school is named after the well-known African American physician Dr. Nathaniel Hawthorne Jones. The school was built in 1959 and originally housed students in grades 1-5 in the segregated Marion County School System. In 1973-1974, N. H. Jones Elementary and College Park Elementary were paired as sister schools arising from a Department of Justice desegregation order. At that time NHJ became an upper elementary school serving students in grades 3-5.

Community aspects that bear mentioning to get a clearer picture of the school are contrasts of affluence and degradation all within a few blocks of the school. Both can be found almost side by side. An observer is able to see houses valued at $80,000.00 at one end of a street and a house valued at $10,000.00 at the other end of the street. Likewise within the school there are the extremes of high

achievement represented by the students attaining the A and A-B Honor Roll and students whose experiences are of failure to read, write, and manipulate numbers at a satisfactory level.

Student Population

The student population consisted of approximately 390 students drawn from an attendance area of about 75 square miles. The demographic breakdown was roughly 65% Black, 32% White, and 3% Hispanic. A retrospective look revealed that these percentages have varied little over the course of three years--the duration of the Chapter 1 schoolwide project. There has been a steady increase in the number of students receiving free and reduced meals from 82% in 1991-1992 to about 92% by the end of the 1993-1994 school year. With Chapter 1 schoolwide project assistance, reduced class sizes were attained over the three school years. In grades three through five the average class size was approximately 22 students.

Faculty

The researcher arrived as principal of NHJ in August of the 1991-1992 school year. At that time the instructional staff of NHJ consisted of thirty-two certificated individuals. All classroom teachers in the third, fourth,

and fifth grades were Florida certified elementary grades 1-6. Some instructional staff had two or more certification areas on their educational credentials. For instance, several teachers carried early childhood education in addition to elementary education. And at least two teachers were certified middle school.

Other teachers taught art, music, physical education, varying exceptionalities, and media. These teachers were certified in those areas but did not have to be certified in elementary education. Table 3 gives a breakdown of teaching experience by years of the instructional staff at NHJ in 1991-1992. The average number of years teaching in Marion County for instructional personnel at NHJ was 12 years. The racial composition of the instructional staff was 55% Black and 45% White.

The Chapter 1 Schoolwide Project

Schoolwide Chapter 1 projects arise from the Hawkins-Stafford Elementary and Secondary school improvement amendment of 1988. Previous Chapter 1 services to students in school districts were limited to specific students of a school's population. The reasoning behind Chapter 1 schoolwide projects was that an educational practice that addresses the needs of an entire instructional program has

greater merit than an intervention that focuses on one or two segments of the program such as math or reading. Hence, Chapter 1 schoolwide projects seek to upgrade the total educational program of a school meeting the established criteria.

In order to qualify as a Chapter 1 schoolwide project a school must show evidence of cultural deprivation in the attendance zone it serves. This deprivation is evidenced through low income families and at least 75% of the students

Table 3

N. H. Jones Faculty Teaching Experience In Years

Years of Experience	Number of Faculty Members
0 - 5	13
6 - 10	3
11 - 15	4
16 - 20	4
21 - 25	5
26 years and above	3

receiving free/reduced meals at school. Additionally, schools may meet eligible status when norm referenced achievement test results indicate that a significant number

of children score below the level appropriate for their age. This score is generally interpreted as the 50th percentile.

During the 1990-1991 school year, the educators at the NHJ school center were presented with the opportunity to become a Chapter 1 schoolwide project school. There were several characteristics that were present that enabled the school staff to decide upon the project designation and the advantages available to a school meeting the criteria. (G. Murphy, personal communication, August, 1991).

The school's demographics showed that 82% of the student body was receiving free or reduced meals. This is indicative of the low socioeconomic status of the community that the school center serves. Beyond low SES was the fact that 50% of the student body received Chapter 1 services in math and reading. These supplementary services were provided to children who scored at or below the 49th percentile on the district administered achievement test. Another factor pointing to the need for intervention was approximately 50% of the third grade students were not on grade level and were assigned preventive strategies according to the tenets of the Florida Primary Education Program (PREP). As well, it was found that a disproportionate number of children were participating in exceptional educational programs. To cite

an example, 35 students alone were being served in the Specific Learning Disabilities (SLD) category representing roughly 9% of the student population.

Cognizant of these school characteristics, the district's federal programs director recognized the schoolwide project as a feasible means of assisting the faculty in the delivery of educational services to the student population at NHJ. (B. Samuel, personal communication, October, 1991).

The State of Microcomputer Technology at N. H. Jones, 1991-1992

When the 1991-1992 school year began there was an IBM computer lab with 18 IBM XT model computers, four IBM pcjr's in the media center, two Apple computers in the Chapter 1 program, and one Apple IIC acquired through the Publix Supermarket Apple for Students campaign.

Additionally, the school district had made available two Macintosh LC II computer workstations for NHJ. One had been delivered and was at the school but still in the box while the other workstation was at a receiving center for incoming district equipment. Software was minimal and consisted mostly of Lintronics, a remedial series associated with the old SSAT requirements and public domain games. And, only two individuals on the instructional staff could be

identified as knowledgeable about microcomputers.

The schoolwide project microcomputer technology expenditure for the 1991-1992 school year was approximately $34,000.00 and went toward the purchase of the AS 2000 which carried a total purchase price of $103,140.00. The AS 2000 is a multimedia system that is designed for teacher and student use and provides instructional activities that promote higher order thinking skills.

The AS 2000 was recommended for purchase in the 1991-1992 Chapter 1 schoolwide project. The principal observed the operations of the system and made a decision to follow through with the purchase. The principal did have reservations about the system and its ability to deliver the services the student body required. A determining factor to proceed with the purchase was that the original group of project planners included the AS 2000 in their expenditure recommendations. The AS 2000 was never utitilized to the degree anticipated and did not have the projected impact on students nor teachers.

Acquisition of Hardware and Software

The Chapter 1 schoolwide project budget for the 1992-1993 school year was $366,400.00. On March 7, 1992, and March 28, 1992, the school faculty engaged in two

comprehensive planning sessions to outline project expenditures. These expenditures included recommended purchases of hardware and software to be acquired for NHJ. The Chapter 1 planning committee recommended $17,000.00 to buy 10 Macintosh computers with printers and $4,000.00 for software, calculators, one Apple overhead projection panel, two video tape recorders, and a Pioneer laser disc player. This recommendation from the planning committee was consistent with the original project goals expressed by teachers of utilizing technology in the school environment.

In the 1992-1993 school year the microcomputer technology expenditure was nearly $20,000.00 excluding $34,380.00 earmarked for the AS 2000 multimedia system. For the 1993-1994 school year the main focus for Chapter 1 expenditures was for staff development opportunities for teachers and acquisition of reading, language, and math software. Teacher staff development was budgeted at $10,000.00 and $4,500.00 was allocated for software.

The Instructional Technology Committee

An Instructional Technology Planning Committee (ITPC) was organized during late May of 1992. The exact date of committee formation was Wednesday, May 27, 1992 (field notes, Dos 1, p. 3, 1992). The school principal selected six

teachers whom he had observed to use instructional technology like the microcomputer, the AS 2000, the hand held calculator, and laser disc player. A memorandum was written by the principal to the selected teachers asking them to be a member of the Instructional Technology Planning Committee. All responses were affirmative and were given the very next day after the memo was placed in the selected teachers' mailboxes. The memorandum also contained the initial meeting date of June 8, 1992, and the time of 12 o'clock noon.

The members of the committee were Ms. Arvin, a veteran teacher of 20 years from a northeastern city district in her first year at NHJ. Ms. Allen, in her first year at NHJ. Ms. Allen had four years of elementary school experience in a Florida school district and was one of two technology workstation teachers selected by the principal during the 1991-1992 school year. Ms. Vance was also in her first year of teaching at NHJ having come from a neighboring school district. Ms. Ryan, was the resident expert on the AS 2000 and had been involved with media and instructional technology for a number of years. Ms. Adams, was a beginning and first year teacher at NHJ. She was knowledgeable in the area of instructional technology and had demonstrated a

willingness to use technology in the delivery of instruction. Ms. Jordan, was the second technology workstation teacher. She was a beginning teacher and the 1991-1992 school year was her first year at NHJ. The final committee member was the school's principal who was in his first year as principal of NHJ. He was very interested in improving educational services to students and facilitating the professional development of teachers through technology.

The formation of the ITPC was a teacher empowerment strategy that the principal as change facilitator believed would contribute significantly to the success of technology diffusing in the school. The initiative would not be a "top down" experience but rather one of teachers having considerable input into the change process. Teachers work on the ITPC would affect their perceived status, knowledge, and decision making (Maeroff, 1988). The ITPC was a democratic forum. There was one vote per member on the ITPC. The principal could not override the decision of a majority. The ITPC allowed teachers to exhibit their knowledge about their profession and technology. And the ITPC gave teacher access to decision making.

The Instructional Technology Committee in Action

Several tasks were outlined for the ITPC. The first

task dealt with questions that needed to be answered from the teachers' point of view in order to get a perspective from which to begin a program to implement instructional technology at the school. The effectiveness of this approach can be compared to a similar stance used in the Shawnee Mission Kansas School District (Chopra, 1994); a study team was organized to answer three fundamental questions prior to proceeding with a technology integration plan. Gattiker (1990) stated that to facilitate introduction of technology, it is important for the organization to assess the beliefs held by its employees. When innovation comes along for the teacher, it means a new set of skills and competencies may be called for; these skills are oftentimes far different from the usual preparation for the required teaching task and may be in contrast to professional beliefs (Gattiker, 1990).

The ITPC identified the purpose for instructional technology in the school environment and generated ideas about how to positively motivate teachers to embrace the innovation. Some of the questions that the committee was charged to answer were: (a) Can the use of instructional technology in the classroom improve, increase, or enhance student achievement? (b) What effect does the introduction

of instructional technology have on teachers professionally? (c) What effect does the introduction of instructional technology have on teachers personally? (d) Why should instructional technology be used in the delivery of instruction at NHJ? and (e) What barriers exist to implementing instructional technology in the curriculum of NHJ? (It is important to note that instructional technology at NHJ was being conceptualized primarily in the form of the microcomputer.)

Teacher answers to these questions were fundamental to embarking on a journey that would ask them to change. Cohen (1987) identified three explanations of why innovations fail. One of those explanations informs that innovations launched may be inconsistent with the teachers' view of instruction. Given the autonomy of classroom teachers, once the classroom door is closed, the innovation can be sufficiently suppressed causing its doom.

The first of three committee meetings convened at approximately 12:20 p.m. on June 8, 1992 in the school's media center. The principal began the meeting by reviewing the instructional technology component of the Chapter 1 schoolwide project. This gave sanction to the proceedings and established instructional technology as a teacher

initiative and not an administrative decision. Sharman (1984, p. 20) related that "all leaders have considerable power to make a variety of decisions unilaterally. On the other hand, prudent administrators involve the employees of the worksite in various aspects of the decision making process. Often this yields better results and certainly fosters better communication between the leader and the followers." Desmond (1980) preceded this assertion having noted that when individual decisions and group decisions are compared empirically, group decisions have been found to be superior. It is generally recognized too, that if you are able to get a person or a group to own a product that has been created then the individual or group will support the product and even come to its rescue when attacked.

This initial meeting addressed the previously mentioned questions and covered a broad range of subjects relative to instructional technology. Without much discussion the committee members unanimously answered "yes" to the question: Can instructional technology increase, improve, or enhance student achievement? The response to what effect does instructional technology have on teachers professionally varied. One member responded that when microcomputers first came on the scene in education she

immediately recognized it as a useful tool and began to learn more about it. Another teacher responded, "Some teachers want to deal with technology and some don't want to work with it (field notes, Dos 1 p. 17, VCR recording A, 1992)." Zaltman, Duncan and Holbek (1973) reminded us that resistance can be a powerful force at the implementation stage because the innovation is at the point of becoming an organizational reality. Another response from a committee member was, if teachers have no instructional technology background there is no interest in using the devices (field notes, Dos 1, p. 22, VCR recording A, 1992).

Still another impact on the professional is the fear factor. Fear has been linked to lack of knowledge and exposure to technology. Giannelli (1985) confirmed teacher fears relating that teacher hesitancy in using technology goes back to ignorance and fear. There is also a loss of self-esteem for the teacher in a setting of peers when the teacher doesn't know about instructional technology. As one committee member said, "If this was the first time you had sat down at a computer and had to be told how to turn it on, it could be embarrassing (field notes, Dos 1, p. 21, VCR recording A, 1992)."

The committee agreed that background differences were

important to understand technology and the teacher. According to committee members, veteran teachers did not have the advantage of instructional technology at the time of their college or university learning experiences. Consequently, their exposure to electronic learning devices is not within and the fear of them is more acute. Kinnaman (1990) observed that computers were not in the experience of teachers with 15 or more years of teaching in either K-12 or preservice education. Younger teachers have experienced technology in their course of study and are more ready to adopt it in the classroom.

Maddux (1991) related that lack of effective training is the reason technology's potential is yet unexploited. Moreover, that same study completed in 1988 revealed that over half of the nation's teachers had not used a microcomputer.

During the meeting it became apparent that committee members believed that sufficient time to learn about technology was an important factor in teachers becoming familiar with a particular device and using that technology to deliver educational services to children. Barker (1990) stated that before any technology can be used productively as an instructional tool, the user of that technology needs

to be thoroughly familiar with the tool. This was the premise upon which the technology initiative at NHJ was conceptualized.

One committee member explained that it takes an enormous amount of time to learn to use technology and then quite a bit of time to prepare a lesson using a particular instructional technology device. Wiske and Zodhiates (1988) reported on a technology project mentioning that teachers emphasized the need for plenty of hands on time to work with hardware and software. Unless a teacher is willing to put forth the effort and time a teacher just might opt to continue lesson presentation the same old way. Panyan, Hummel, and Jackson (1990) affirmed that comprehensive training in the successful use of microcomputer technology should recognize teachers' willingness to change and their readiness to adopt to new educational practices.

Another point of consideration by committee members was that something had to be done to make the professional feel comfortable with technology. In order to make teachers comfortable they need time to work with the devices. This includes planning time and actual time exploring the particular technology. Fulton (1989) conveyed that reservations about microcomputer technology and related

anxieties can best be defeated by time and practice--time to experiment and practice to develop confidence. Another suggestion from the committee was to allow teachers to observe instructional technology in action and give teachers time to become familiar with the technology that would be used to deliver instruction to students. This was addressed in part on October 27, 1992 when the members of the ITPC visited Webster Elementary School a Model Technology School in Saint Augustine, Florida. Munday, Windham and Stamper (1991) related that effective practices coupled with technology will help teachers become more productive with students given that teachers have opportunities to learn about the technologies that are provided.

A very important point was brought to bear by Ms. Arvin, in that using technology is a kinesthetic/tactile modality (field notes, Dos 1, p. 24, VCR recording A, 1992). Many teachers' learning modality is not kinesthetic but visual or auditory. Instructional technology creates a conflict as far as style of learning for some teachers. This became evident later on in the study when in interviewing teachers to determine their level of use of microcomputer technology it was expressed by a teacher that she was not "mechanically inclined" and that the kinesthetic modality

was a weakness for her (field notes, cassette recording 20, 1993). As well, many teachers teach to the modality of their strength and also learn in the modality of their strength. When the teachers primary learning modality is other than kinesthetic a problem of fear, limited use or nonuse of technology can occur in the classroom.

The next question answered was what effect does instructional technology have on the teacher personally? The first response came from Ms. Arvin. She related how some districts and some schools do not give incentives for teachers to improve their skills and competence. In this view instructional technology was looked upon as an attempt to improve professionally. It was mentioned that often a teacher has to foot the bill to learn to use instructional technology. The teacher purchases a microcomputer and software for self and then uses it to improve instruction.

Instructional technology has to be readily available and not removed from the teacher, commented a committee member (field notes, Dos 1, pp. 56 and 86, VCR recordings A and C, 1992). Some teachers will not put forth the extra effort to learn the new teaching technology if it is distant and not accessible. Teacher access to instructional technology would be a key in the success of a technology

initiative. This became clear to the ITPC when in the meeting it was mentioned by one teacher that the placement of the AS 2000 in the media center created a difficulty for her to use it with students. The housing of the technology makes a difference in it being used. The more accessible technology is to teachers increases the likelihood that they will use it.

The next question for the committee's consideration was why should instructional technology be used to deliver instruction at NHJ? The first response was that instructional technology can be used as a motivational tool. This response is consistent with Lappan and Wilson (1987), Caissy (1987), and Becker (1990a), who mentioned computer based activities as motivational for students. It can promote student learning through the avenue of media rather than the constant use of traditional teaching methods. Bailey and Lumley (1991) stated that a teacher using technology to motivate students is more productive than one simply using lectures and textbooks.

Since students at NHJ will be entering a world that will be driven by computers and other technological advances, their exposure to computers, calculators, laser disc video, and multimedia like the AS 2000 will assist

their familiarity with technology and decrease the fear of learning to use technology. Caissy (1987) and Becker (1990a) extend the relationship of computer based activities and students indicating that student academic performance improves with computer contact.

Next, the committee entertained the question of barriers to implementing instructional technology in the classroom? One response was "Are there enough of the devices for me to have one in my classroom (field notes, Dos 1, p. 12, VCR recording A, 1992)?" The answer to this question became a disheartening reality by not being adequately addressed at NHJ until the beginning of the 1993-1994 school year. A subsequent response was how will I work the instructional technology into the classroom. Each response led to another question like how long will this device be available for me to use and what kind of technical support will I receive when using che technology in my classroom? A concern was raised regarding the worth of getting started to use a device if it is subject to being down. "This can result in a loss of continuity depending on how long a piece of equipment is not operating." said a committee member (field notes, Dos 1, p. 12, VCR recording A, 1992).

In answer to the question, "Has instructional

technology caused you to change the way you deliver instruction in your classroom and how, the committee members again answered unanimously, "yes" (field notes, 1992). The how portion of the question was somewhat more difficult to answer. Responses were it takes more time to use instructional technology because it has to be planned in greater detail, the transitions are not as swift like going from paper to book and working with machinery is not as second nature as working with chalk and eraser as yet (field notes, 1992).

It also appears that discipline presents more of a problem when teaching with instructional technology. When a teacher is concentrating on the keyboard or monitor, the teachers' attention is turned away from the students. When a problem occurs with the instructional device often the instructional momentum is lost. Dockterman (1991) in contrast related that using a specific technology like the microcomputer with a projection panel helps the teacher maintain eye contact with students thereby discouraging student misconduct.

The second meeting of the ITPC was on July 17, 1992. The members met for breakfast at a local restaurant before proceeding to school to debate the subject of technology.

The principal began the meeting by reviewing discussion items from the June 8, 1992, meeting. One of the first topics of conversation was teacher training. "Teachers have to be trained," said Ms. Vance. "You put a computer in without training and it winds up in the back of the room (field notes, Dos 1, p. 41, VCR recording B, 1992)." The topic of training was the focus of attention for the committee for a short time.

This topic logically led to a discussion on how to provide training for teachers. Utilizing the designated half days set aside for parent and teacher conferences, release time in the form of temporary duty elsewhere (TDE), Chapter 1 purchase of substitute teachers, and district sponsored support were all mentioned as possible ways to provide training for teachers. It was pointed out by a committee member that release time should only be given to those teachers who are willing to use technology since training time is expensive. Another aspect of training was brought out by members was that inservice activities needed to be meaningful to the teachers and centered around what they wanted in the way of training. Stakenas, Tishkin, and Resnick (1992) proposed that inservice training for teachers be based on the level of expertise of each teacher to

eliminate frustrations that might arise when novice and experienced teachers are in the same inservice. Finding out what teachers wanted would be a key factor in setting up workshops and providing training sessions.

The committee then engaged in a conversation about the capabilities of various instructional technologies and believed that the NHJ effort might be improved if teachers knew the capabilities of various devices and how they could be used in the classroom with students. This delineation of capability was recognized by the committee as a sizable task. An effort was made during the 1992-1993 school year to link devices with capabilities but did not receive enough attention and coordination to be promulgated in written form to impact the technology adoption process.

A concern was expressed about the amount of time students would receive computer-assisted instruction (CAI). A brief conversation ensued with committee members suggesting a definite amount of time for students to learn with CAI. Committee members believed that minimum student contact with computers should be one hour per week. The results of research on computer instruction that assists teachers yielded that students learn 10-40 percent more in a given time if objectives are specifically defined,

appropriate software is used, and students are allowed 12 to 20 minutes of quality computer-assisted instruction at least 4 times per week (Valdez, 1986). Crumb (1990) mentioned research by Bangert-Drowns, Kulik and Kulik (1985) on the effectiveness of computer-assisted instruction finding that students receiving CAI scored better on standardized achievement tests than students who had no instruction using CAI. Also, students' long term retention rates after CAI was at least equal to or better than students exposed to traditional instruction (Bangert-Drowns, Kulik & Kulik, 1985; Valdez, 1986). And, when CAI is used to supplement the curriculum, students hold higher or equally positive attitudes about school (Bangert-Drowns, Kulik & Kulik, 1985; Valdez, 1986).

The final meeting of the ITPC convened on July 3, 1992. One of the substantive issues of this meeting was to determine equitable distribution of technology to teachers. One way this could be accomplished was to take inventory of all instructional technology and then divide it equally to each grade level. The purchase of microcomputers would certainly create a political situation of who would get what and when, but would there be sufficient willingness and enthusiasm on the part of teachers to create a driving force

toward becoming users of microcomputers? As far as microcomputers were concerned, committee members with smiles on their faces remarked, "Those who are willing to use them should be the ones to get them (field notes, Dos 1, p. 47, VCR recording B, 1992; Dyrli & Kinnaman, 1994)."

Peripherals for the computers also became a point of discussion because it was realized that the computer without a printer would not be an effective setup. And for the initiative to be successful appropriate software had to be purchased.

By the end of the third meeting, the committee had discussed and made decisions on a broad range of educational matters and not just instructional technology. In the planning process the teachers had moved from the confining viewpoint of instructional technology in the classroom to include how technology could improve the school, how teachers could be renewed through technology, and how the entire sociocultural system of the school could be changed.

The principal asked ITPC members if they were willing to serve as resource people in the technology initiative. They would be a first line of assistance in helping other teachers in using the computer and other devices like the laser disc player and to a degree the AS 2000. The committee

members agreed to act as resource persons their grade level and to other teachers who may need assistance with technology.

Mentioned in the ITPC meetings was the idea of a lesson plan format to be used by teachers. The lesson plan would be one way that teacher use of instructional technology could be insured. Mojkowski (1989) gave lesson plans an eminent place in teaching calling them specific guides for instruction. The school principal also held lesson plans to be a very important and essential part of the teaching and learning process. It was suggested during the meeting that ten lesson plans using technology be developed by teachers during the year. This number was reduced to five as the 1992-1993 year unfolded because of English for Speakers of Other Languages (ESOL) inservices mandated in the district.

At the end of the meeting the principal reviewed the important points of all three meetings. He informed members that he would synthesize the key points of the meetings into a plan for the school. This plan would be mailed to them for their review and comments before the start of the next school year.

Summary

There were educational needs at NHJ pertaining to

student achievement and teacher professional development. Student achievement data strongly suggested that some intervention be introduced to improve test results and get students working on their assigned grade level in math and reading. Technology surfaced as a means through which student achievement and teacher development could be positively addressed. The Chapter 1 schoolwide project resources applied to the school center were intended to positively affect teacher and student needs. Rush (1974) described the change process as an effort by the organization to improve its effectiveness in solving its problems and reaching its goals. For NHJ, the problem was to increase student academic achievement and provide teachers with resources necessary for them to perform the task of teaching and improve student outcomes. This reality alerted others to the need to consider assistance for NHJ.

With the identification of technology as an intervention to make a difference at NHJ came the need to plan and coordinate its introduction. The ITPC was created to conduct the initiation and implementation of technology in the school environment.

It was the consensus of the ITPC that from beginning to end the process of integrating microcomputer technology into

the school environment and achievement of the goals of the technology plan would take approximately three years. One teacher remarked, "I think we all decided that it can't be an overnight process. A plan of 3-5 years to get all teachers to use technology is realistic (field notes, Dos 2, p. 5, cassette recording D1, 1992)." It was believed that in one year, however, substantial progress could be made to develop positive teacher attitudes toward using instructional technology and that student experiences with microcomputers could be increased.

CHAPTER 4

THE UNFOLDING OF THE N. H. JONES TECHNOLOGY PLAN, 1992-1993

Prerequisites for Technology Planning

Cory (1983) advanced the notion that no purchase of hardware or software be done in a school system implementing microcomputer technology until a plan is in place and a rationale developed for the purchases. In what may be considered a paradoxical evaluation, she further explained that a school system cannot know fully what to do with microcomputers until teachers know what to do with them and teachers cannot know what to do with microcomputers until they are purchased. Cory (1983) also cautioned that the introduction of microcomputers into the school curriculum is significantly different from other types of changes or innovations. She listed three reasons why implementation of microcomputer technology is more complex than just introducing a new teaching method. The reasons were: (a) there is not an already trained group of teachers who know how to use the microcomputer in the classroom, (b) there is not enough money available to purchase the materials

necessary for full implementation, and (c) there are no prototype plans existing from which a school or district can select to follow. All of the conditions mentioned by Cory as precautions to implementing microcomputer technology were addressed through the establishment of the NHJ technology committee and the Chapter 1 schoolwide project.

The Instructional Technology Plan

The research literature on which the conceptual framework of this study is based recommends developing a plan to introduce technology into the school environment. The NHJ instructional technology plan emerged from the summer 1992 meetings of the ITPC. The work of the committee provided answers to important questions and erected a framework upon which the school could proceed to adopt technology. The committee members in their deliberation on technology produced a school philosophy on technology and also developed belief statements to accompany the technology plan. The NHJ philosophy on instructional technology stated:

> The NHJ staff believes that instructional technology can make instruction and learning more efficient and effective. The staff believes that there is a new world of learning presented by technology waiting to be explored. We believe that the entire school family--

students, teachers, parents, and community stand to benefit from technology's incorporation into the curriculum. Students will be required more and more to be users of technology in their lives. The classroom is the opportune place for students to acquire the skills to manipulate technological devices. At NHJ, we view the incorporation of technology into the school curriculum as both a responsibility to students and society and a professional obligation to growth and development (field notes, 1992).

For the 1992-1993 school year nine short term goals were identified. Again the planning committee members realized that a plan of implementing technology into the school curriculum was not a quickly accomplished endeavor. In fact, a committee member remarked, "We are in a process and any kind of change takes time. You don't just wave a magic wand . . . . everything is as you want it to be (field notes, Dos 1, p. 91, VCR recording C, 1992)." Persky (1990) commenting on a technology project, asserted that using technology is not easy and that it does not happen overnight. This statement supports remarks of teachers made in ITPC meetings.

The 1992-1993 goals for instructional technology at

NHJ were:

a. prepare students for life and work in a world that is increasingly dependent upon technology;
b. every teacher will become familiar with and feel comfortable with one or more instructional technology device(s);
c. create a library of instructional technology lesson plans for teacher use;
d. gather research articles on the implementation of instructional technology in the curriculum;
e. begin instructional technology purchase for every teacher to have a computer in the classroom;
f. begin instructional technology purchase for every teacher to have a set of calculators in the classroom;
g. all students have access to computer assisted instruction for at least one hour per week;
h. provide adequate planning time and inservice for teachers to become familiar with and practice using selected instructional technology devices; and
i. a group of NHJ teachers visit a model technology school during the 1992-1993 school year.

The ITPC also developed a lesson plan form for teachers

to use in documenting their use of technology (field notes, Dos 1, p. 84, VCR recording C, 1992). Teacher technology lesson plans were to be placed on file for other teachers to use. The technology plan also called for teachers to select the instructional technology they wanted to use during the 1992-1993 school year. This was a key element and involved all teachers in the technology initiative.

In addition to the technology goals, inservice training was also a very important element that would contribute significantly to the success of the plan. As mentioned by one committee member, "When you increase the amount of technology in the classroom you also increase the need to have someone on staff to assist teachers to utilize technology (field notes, Dos 1, p. 70, VCR recording C, 1992)." This statement is supported by Sheingold (1991) who concluded that: (a) technology demands hardware, software, and technical support in schools, and (b) it needs people who can help teachers integrate the technology into their practice.

A Cadre of Experts

The success of the NHJ technology plan depended upon teachers. The premise from which the innovation proceeded was that teachers first had to be literate in using

technology in order to appropriately apply a particular device's capabilities to the teaching and learning process to benefit themselves and students. There is substantial support for the hypothesis that computer and other technologies can improve learning when it is in the hands of informed and able teachers (Wyatt, 1985).

The NHJ plan for teachers to use technology was advanced with the Specific Expertise Model (Van Horn, 1990). In the model, teachers are encouraged to become experts in a specific technology. Once teachers have become proficient in the use of that technology, they would be able to assist other colleagues interested in using that technology. With NHJ teachers choosing different technology to work with, there would be sufficient experts present to assist other teachers. There was an expectation that each teacher would select a technology like the microcomputer, laser disc player, AS 2000 or other device in which to become expert. The teachers who made up the ITPC formed the cadre of experts who would be the foundation from which the technology plan would proceed. This group was motivated and had enough expertise to launch an aggressive movement to adopt instructional technology. Kloosterman, Campbell, and Harty (1987) in their attempt to understand the initial

stages of microcomputer use in schools recognized the process as beginning with a cadre of teachers who were motivated by the potential of microcomputers in the learning environment. This cadre of teachers in turn ignites the interest of other teachers in the environment to become users.

The researcher had the opportunity to ask the question of barriers to instructional technology to a teacher from another district school. The teacher was being interviewed for a position at NHJ. The teacher was asked a question on inservices and she mentioned instructional technology and that teachers were afraid of using it in the classroom. The follow-up question was why was that so? The teacher related several points about technology and teachers. She said that teachers feared failure in that they would not be able to perform a task with instructional technology in front of their peers. There is also an access problem with particular instructional technology devices like the microcomputer. This teacher went on to say that teachers are not confident in their ability to use the technology in the classroom and that there are so many instructional technology devices in the educational setting that there is a feeling of being overwhelmed. This is a sentiment that was reached by members

of the ITPC during the summer of 1992 (field notes, 1992). Another candidate was selected to fill the advertised position for which this teacher was interviewed.

Teachers Choose Technology

The ITPC applied considerable pressure to mandate use of technology by teachers. During the first meeting, one committee member remarked, "You can't leave it up to teachers to decide and I know what you are saying that teachers always have something thrown at them, but some things you throw at them because they never make the change." "You just can't throw it down their throats because I know certain teachers at this school who would just have it in the room and it would collect dust," remarked another committee member (field notes, Dos 1, p. 28, VCR recording A, 1992).

From the very beginning of the technology initiative it was the aim of the principal not to force or pressure teachers into using technology. Willis (1993) believed that voluntary participation correlated positively with longevity of successful technology projects. The principal of NHJ believed that the technology initiative could be successful without pressuring teachers. Additional support for this perspective was found in Gillman (1989, p. 11) who said,

"The underlying concept, which is common to most successful training and learning situations, is this: unpressured exposure to new ideas along with adequate time to assimilate, experiment and practice new procedures promote confidence and willingness in use." The NHJ change process would be one where teachers had considerable input in the change process. They would be empowered to make decisions. With empowerment, however, teachers would have a sense of deportment concerning authority and not just issue orders to other teachers (Maeroff, 1988).

In response to committee pressure to mandate use of technology by teachers, the principal responded stating that we could work around the mandate to force the use of technology and the possibility of total rejection. He called for a plan wherein teachers would be asked to use technology. They would not have to specifically use the microcomputer, the AS 2000, the laser disc player, or calculators, but teachers would have to use something. It would be up to them to decide what it would be. Various incentives would be presented that would encourage, persuade, or convince teachers that technology was alright to use and that it was not life threatening.

The thrust to infuse technology at NHJ began in earnest

during preschool of the 1992-1993 school year. At this time the first phase of the plan unfolded; teachers were expected to choose an instructional technology in which to become expert. Teachers received a list of available technology and decided upon the one they would become expert in that year.

Starting Out in Technology

The start of the 1992-1993 school year brought with it great anticipation with regards to technology and expectations of what technology could do for teachers and students. The ground work to launch into an exciting year with instructional technology as a galvanizing agent had transpired within the Chapter 1 planning team, the ITPC meetings, and the instructional technology plan. NHJ now had the basic foundation to enable the teachers to move ahead with technology. NHJ had a technology plan developed with the input of teachers, there was a cadre of experts to diffuse the innovation, and an inventory of technology that would at least get the innovation started. And since the school was heading into uncharted waters, time to make adjustments, should they be necessary, was available. (The principal believed that the initiative could sustain itself with the technology present at the school knowing that additional technology was forthcoming through Chapter 1

expenditures.)

One of the first things to be accomplished at the beginning of the 1992-1993 school year was to coordinate the elements of the plan. The ITPC acted as a clearinghouse for technology distribution and needed to know what each teacher wanted. Each teacher was informed to select the technology they would become expert in over the course of the year. Before this could occur, however, a system had to be devised that allowed for the equitable distribution of existing instructional technology to teachers. As well, there were some electronic devices like the laser disc player, video camera, and video tape recorders that had to be shared among faculty because not enough of them were in the present inventory.

During pre-school week in August 1992, an instructional technology planning form was given to teachers. This form assisted the principal and the ITPC in assessing the level of expertise each teacher had in using various instructional technology devices, how often the teachers used the technology, and whether or not access to the devices posed a problem for them. This information provided a basis for identifying teachers' level of expertise and knowing the specific instructional technology device a teacher was

interested in using.

With this information the principal with the assistance of the ITPC proportionately distributed the inventory of technology in the three grade levels. Dyrli and Kinnaman (1994) referred to this action as the uniform distribution approach commenting that it is almost never the best approach for a number of reasons. Those reasons are: (a) given the cost of technology it is not reasonable to place technology in rooms where it will not be utilized, (b) microcomputers in classrooms collecting dust benefits no one, and (c) this action represents mass production and does not account for the unique characteristics within the school.

Once the distribution of technology was accomplished, teachers were then asked to select the technology they would become expert in over the 1992-1993 school year. The committee did not have the availability of Dyrili and Kinnaman's (1994) observations at the time of the decision. In retrospect, the conclusions of Dyrli and Kinnaman have merit. The researcher's observations confirmed that teachers did not always use a piece of equipment even though it was in the classroom.

The inventory of technology equipment was divided into

eight categories. Each of those categories reflected a degree of difficulty in use. Moving from category one to category eight entailed additional investment of time and practice to master the devices capabilities. Table 4 lists the technology devices classified by their level of difficulty. Table 4 also shows the number of teachers choosing technology in each category.

The Tandy computer was acquired through the state of Florida and the Tandy Corporation. The two entities through a joint agreement allowed for the distribution of a teacher workstation in Florida schools.

Nine teachers on the staff elected to become experts in the use of the microcomputer. Two of the teachers were from third grade, five of the teachers were from fourth grade, and two from fifth grade. All of the ITPC teachers requested a microcomputer.

By the time that teachers filled out the technology selection sheet, NHJ received a shipment of four IBM PS/50Z model computers. The arrival of these units assisted in accommodating those teachers who had requested microcomputers.

In October 1992 there was the awakening also to the fact that NHJ was not able to accommodate the microcomputer

Table 4

NHJ Technology Devices Classified by Difficulty of Implementation and Number of Teachers Choosing Devices in each Category of Technology, August 1992

Category	Technology Device	Number of Teachers
One	Video Tape Recorder Tape Recorder Overhead Projector	4
Two	Calculator Calculators with Overhead Projector	8
Three	Video Camera and Media Production	1
Four	IBM computer and Software/Macintosh computer and software	2
Five	Macintosh computer, software and Overhead Projection Panel	3
Six	Tandy Computer and CD-ROM	0
Seven	Macintosh computer, Overhead Projection Panel, and Laser Disc Player	4
Eight	IBM Computer Lab or AS 2000	3

Note: Teachers chose more than one category. Five teachers chose two categories and one teacher chose three categories in which to become expert. The Tandy computer was never been put into service because of a software flaw.

selection of three teachers, one of which was a special area teacher. At this time it appeared as though NHJ's instructional technology was outpaced by teachers' desire to use computers. Those teachers not receiving a microcomputer system asked to wait for the arrival of the Macintosh LC systems.

On October 2, 1992, the ITPC held a meeting in the media center. One important request surfaced and that was the availability of release time for teachers to work with their technology. There are several things that administration can do to support staff development in technology. Two that are mentioned by Clemente (1991) are seeking teacher advice on long range staff needs and finding ways to free teachers to become familiar with technology. During this meeting the principal indicated that he would devise a plan that would allow teachers working with technology to have one day or a half day for this activity. For the purpose of accountability, however, teachers using release time would submit a one page document describing their activity with their selected technology.

The instructional technology initiative struggled through the first semester of the 1992-1993 school year. A disheartening fact was that the 10 Macintosh computers and

printers ordered in September 1992 by the Chapter 1 office (April 1992 by NHJ) had not arrived. No one at school suspected that the shipment of microcomputers would be so long in getting to NHJ. On a positive note, however, the researcher did observe one teacher consistently making progress with her chosen selection--the AS 2000 and that was encouraging to see.

December 1992, was a technology bonanza month. NHJ received three sets of classroom calculators, one Pioneer laser disc player, and five overhead projectors, but no microcomputers or printers. It would be April 16, 1993, before the ten Macintosh computers and printers would arrive.

It is difficult to estimate the negative impact not having the Macintosh computers available to teachers had on the technology initiative. Whether or not teachers who made the requests would have used them extensively is not known. What impact on teachers the microcomputers may have had will not be known. (Prominent in teacher beliefs about technology and their actual use of it was access to technology.)

NHJ launched its technology initiative in May 1992. By December 1992, eight months had passed with what appeared to be little overt change. A few teachers seemed to be trying

their technology but no explosion of use had occurred. No great conversations outside of the ITPC could be heard. Levinson (1990) described implementation as an encounter between an existing school system and innovation. He discussed three possible outcomes of the encounter. One of those outcomes is referred to as technical implementation. This outcome is characterized by the innovation being in place but not sufficiently used. NHJ was experiencing this outcome in regards to its innovation. From observations it was clear that NHJ teachers were still operating in a traditional way.

Teacher Training, 1992-1993

The training of teachers to use microcomputer technology in schools is viewed as the key ingredient in fulfilling the promise that technology holds for education. A paradox of this reality, as Boe (1989) observed, is that during the early stages of technology implementation in schools, training is often overlooked entirely. Often, machines and software are purchased and installed, and pushed at teachers but teachers are provided with neither the time nor the resources for training (Boe, 1989).

During the 1992-1993 school year teacher training activities were limited. Some of the reasons for this

reality was NHJ was in a new process and much uncertainty existed about what to inservice teachers on (field notes, Dos 1, p. 88, VCR recording C, 1992). There was ambivalence about what type of training teachers should receive. The technology plan was new and there was a period of adjustment that the teachers had to experience. Questions about what software to inservice teachers on and to what extent the software would affect teaching and learning was being debated. Then, ITPC committee members who were responsible for securing the training or providing the training were not experts in every technology category. As mentioned in the summer meetings by a committee member, ". . . we cannot be experts in everything (field notes, 1992)."

Teachers were also in the traditional mode of teaching. The innovation was still too new and moreover its diffusion depended upon the initiative of teachers. Time to plan workshop activities for teachers along with other demands of the profession created a problem that resulted in little training for teachers. The initiative was getting off to a slow start.

One committee member summed it up earlier when she remarked, "Well, I think it was definitely a process because in the beginning none of us including you . . . . knew

exactly what we were going to do (field notes, Dos 2, p. 3, cassette recording D1, 1992)." The ITPC was still trying to coordinate elements of the plan, the principal was attending to administrative responsibilities, and there was no one designated person to coordinate the technology plan. Hence, the pace of diffusion of technology for the first semester eased along gradually--almost imperceptibly.

A Turning Point

February 1993 appeared to be a turning point in the change process. Conversations with teachers evidenced a heightened interest in technology. NHJ had moved slowly with the technology initiative up to that point, but there began a gradual and noticeable move by teachers toward using technology. There are several reasons that can be cited for this conclusion. One, teachers saw other teachers making progress with their technology, especially the microcomputer. Two, teachers began to be jealous of the time some teachers were able to get to practice with their technology. Three, teachers perceived an inequity in the distribution of microcomputers and wanted to be treated fairly with respect to them. And fourth, teachers began to see the value of the microcomputer as a tool as the ITPC teachers discussed their successes.

Teacher training in the second semester took the form of teacher release time. These were full or one half days that were arranged through the principal where teachers could use this time to become familiar with their chosen technology. Again, the ITPC members took the lead in taking advantage of this opportunity. These teachers had chosen the microcomputer and related software as their technology. A possible explanation to answer the occurrence of why more teachers did not take advantage of this opportunity is that other teachers had chosen less complicated technology and perhaps did not need the addditional time to become familiar with its use.

A key to the eventual change process and microcomputer technology was a software program called Gradebook Plus. Ms. Allen, a member of the ITPC began using the program during the first semester of 1992. Shortly thereafter she began to extol the virtues of the program and other ITPC members became interested in the product.

Another key aspect of the second semester impetus was that teachers had chosen to be expert in a particular technology. They were to write five lesson plans on the technology and those lesson plans were to be filed for possible access by teachers who might want to use a plan

working with that particular device. Teachers became serious about doing what they said they would do. Lesson plans began to come in to the principal over time and teachers were conscious of the fact that they needed to be turned in.

The Innovation Redefined

The ITPC met on March 2, 1993 to evaluate the school's instructional technology efforts and to generate ideas that would continue to promote the initative. This meeting was also a defining moment in the life of the technology project at NHJ. The ITPC met for the entire day to deliberate on the progress of the instructional technology initiative. Prominent in the discussion was how to increase the number of teachers using microcomputers, determine future instructional technology needs, disseminate knowledge of release time options for teachers to become familiar with their specific technology, and inform teachers that there was a resource technology person in every grade level available to help them. The committee began to review its efforts in disseminating information about release time and a resource person and wondered if the notice to teachers about these opportunities was sufficient.

Being close to the end of school there was also a need to remind teachers of the lesson plan component of the

school's technology plan because these were coming in gradually. Matters of acquisition of more microcomputers, software, printers, and how to integrate them into the already existing plan were of importance to deliberate upon. While all of these were important and were discussed, the most significant idea to arise during the meeting, however, was the deletion of technology devices that were considered too basic and did not really fit the definition the ITPC was working with under the heading of technology. Committee members believed that the microcomputer was the technology that would make the difference at NHJ and the other devices really should not be a focus of attention.

The initial thrust in technology included a number of instructional technology devices. They ranged from the microcomputer to the AS 2000, to the video camera, VCR, and laser disc player. Devices in the lower categories were inserted to lessen teacher fears of using technology and was a gentle way of nudging them forward using things with which they were already familiar. The work of the committee in March 1993 redefined the technology initiative. From this point forward the innovation evolved from instructional technology to microcomputer technology. There was a decided shift from many devices to the microcomputer workstation

which would include specific software and peripherals. At NHJ, the workstation was configured as an IBM or a Macintosh microcomputer with printer. With software, such as Gradebook Plus and Lesson Planner, teachers would be able to use the workstation as a tool to enhance their productivity or use the setup to engage students in academic work. In retrospect, the redefined innovation conformed to the requirements of the Innovation Configuration dimension of the CBAM model.

Factors That Promoted Diffusion, Adoption, Use and Integration of Technology

The March 2, 1993 meeting also gave opportunity for the researcher as change facilitator to ascertain factors that promoted instructional technology in the NHJ environment. Table 5 contains results of teachers' responses to a questionnaire about factors that promoted technology at NHJ. The factors teachers indicated as promoters of diffusion, adoption, use, and integration were supported by the game plan components of the change facilitator strategy. Interventions by the change facilitator with specific game plan components were an important part of the change process in the use of microcomputer technology by teachers. Table 5 also shows the category of game plan components and where the components were used to reinforce what teachers

Table 5

Teacher Perceived Factors That Promote Diffusion, Adoption, Use, and Integration of Instructional Technology at N. H. Jones, March 1993

Factors	Game Plan Component
Technology Resource People	GPC 3
Release Time for Teacher Training	GPC 2
Teacher Training	GPC 2
Planning Time	GPC 1
Access to Hardware and Software	GPC 1
Enough Time for Implementation	GPC 1
Nonpunitive Environment that Accepts Failure	GPC 1
Security for Equipment	
Administrative Support	GPC 1
Colleague Assistance	GPC 1, GPC 3
Monitoring System to Determine Progress	GPC 4
Consistency in Using Technology	GPC 4
Equity in Distribution of Hardware and Software	GPC 4

recognized as factors promoting the use of microcomputer technology at NHJ.

Identifying perceived barriers to using microcomputer technology was one of the research questions of this study.

It was important to ascertain information from teachers concerning barriers so that progress toward teachers' use of technology could be maintained. In May 1993, ITPC members identified a number of barriers to technology they believed present at NHJ. Those barriers are identified in Table 6.

In the final analysis, change creates opportunity when people have planned for it, are prepared for it, and know what to do when the new replaces the old (Kantor, 1983). For the NHJ experience, the prevailing belief was that a well laid foundation of planning had taken place. The ITPC was a functioning committee that addressed problems as they arose and new people helped to displace the forces of resistance among teachers.

Near the end of the 1992-1993 school year an effort was made to evaluate the effectiveness of the technology initiative through a survey of teachers. The information gathered from teachers concerning the NHJ technology goals are contained in Table 7. Results of the survey indicated that progress had been made in several goals of the NHJ technology plan. The effort to acquire instructional technology was favorably evaluated. Release time opportunities were recognized as being available. And teacher access to the technology device they selected was

Table 6

Teacher Perceived Barriers to Instructional Technology at N. H. Jones Elementary, May 1993

Barriers
Lack of Training
Limited Access to Hardware and Software
Lack of Interest by Teachers
Fear of Failure
Lack of Time to Learn about Technology
Lack of Knowledge of How to Integrate Technology into Curriculum
Student Discipline
Teachers Already Burdened with Things to Do
Fear of the Innovation

evaluated positively. The survey also made the principal as researcher aware that there was still work to accomplish in getting teachers to use technology. There were a number of teachers who had not taken advantage of release time to become familiar with their selected technology. There were teachers who had not completed their lesson plans which indicated nonuse of the selected technology. And teachers recognized a need for more inservice training and release time to become expert in using their selected

Table 7

Instructional Technology Evaluation Questionnaire, May 1993

Question	Number of Teachers Responding Yes	No
1. Do you have access to your selected instructional technology device(s) for the 1992-1993 school year?	16	8
2. Have you had opportunities to utilize and become familiar with your instructional technology device(s) during the 1992-1993 school year?	16	9
3. Was release time made available to you to become familiar with your selected instructional technology during 1992-1993?	14	9
4. Did you take advantage of the available release time to utilize and become familiar with your selected instructional technology?	10	12
5. Do your students have access to computer assisted instruction for at least one hour per week?	11	11
6. Has an effort been made at NHJ to acquire the instructional technology necessary for plan implementation?	15	9
7. Is research literature on using instructional technology in the classroom being made available to you?	7	15
8. Have you contributed at least five instructional technology lesson plans to build a library of resources?	4	15
9. Have you assisted a colleague(s) in becoming familiar with and utilizing instructional technology in the classroom?	10	12

Table 7--continued

10. Is there a need for more inservice training and release time for you to become expert in your selected instructional technology?	18	6

Note. Responses are from 25 NHJ teachers completing the evaluation questionnaire.

technology.

Summary

Teachers were recognized as the key to the success of the innovation at NHJ. They would also be the reason for its failure. The strategies utilized were designed to increase the likelihood of teacher acceptance and use of the innovation. The unpressured approach to acceptance and use of technology was calculated to be a better way of moving teachers through the change process and toward embracing technology. Teachers were empowered through the voices on the ITPC. In this forum the status of teachers was elevated, their knowledge was sought and they were involved in the decision making process.

Implementation is concerned with the actual utilization of the innovation by the members of the organization (Zaltman et al., 1973). An important factor in the success of the implementation process was a cadre of teachers interested in technology, motivated to use technology, and willing to serve as resource persons for

other teachers. The ITPC was a major factor in the introduction of the innovation and the change process. The ideas generated from meetings in many instances preempted problems that arose from the initiative before they blossomed. Dyrli and Kinnaman (1994) stated that a strong technology committee at school can mediate disputes and achieve consensus among faculty members. The ITPC was indispensable in seeing and addressing problems before they wreaked havoc for the initiative.

The training of teachers in the use of technology emerged as an issue during the 1992-1993 school year. Because teacher training opportunities were limited, the technology initiative proceeded slowly. It was apparent to the researcher as change facilitator and to the ITPC members that workshops and other training opportunities would be needed to continue the move toward teachers' use of technology. A case for underestimating the magnitude of the technology initiative and the change process for teachers can certainly by made. Because teacher training opportunities were limited, the technology initiative proceeded slowly. It was apparent to the researcher as change facilitator and to members of the ITPC that workshops focusing on the technology were needed and time for teachers

to take advantage of the workshops was a prerequisite.

Participation and support (Clemente, 1991) by the school principal was essential in adopting technology. There was considerable support by the principal at NHJ and this involvement was cited as a positive influence for technology in the school (field notes, 1994). The principal established a nonpunitive environment wherein teachers could experiment with microcomputer technology. Teachers were encouraged one-to-one to continue using microcomputer technology, and teachers were provided innovation essentials enabling them to become proficient users of microcomputer technology. And the resources of the Chapter 1 schoolwide project cannot be underestimated as that support greatly influenced the outcome of technology in the NHJ environment and effectively launched the innovation.

Around February 1993, teacher attitudes about technology seemed to shift toward positive acceptance. Conversations with teachers indicated a heightened interest in technology. Release time available to teachers to practice with their technology appeared to be a catalyst in the process. This turn of events was greeted positively by the change facilitator and reinforced the need to continue to provide means for teachers to use technology in school.

The ITPC meeting in March 1993 was a decisive moment and redefined the technology initiative. A decision was made to streamline the technology innovation and make it more manageable and meaningful for teachers to use. The innovation was reconfigured from a diverse collection of instructional devices to a microcomputer workstation. In retrospect, the decision to redefine the innovation was pivotal in the eventual success of the initiative. By redefining the initiative, the ITPC made the innovation more manageable and easier to monitor the concerns of teachers and their level of use of the innovation.

CHAPTER 5

N. H. JONES ELEMENTARY: INNOVATION IMPLEMENTATION, 1993-1994

Teachers Commit to Technology

On May 5, 1993, the NHJ faculty had a school improvement meeting to review the 1993-1994 school improvement plan as required by the state of Florida and written by the school Leadership Team and Advisory Council. The plan was comprehensive covering the seven goals identified by the state of Florida and it included a teacher goal for the upcoming school year of using microcomputer technology to word process, write and maintain lesson plans, generate reports, maintain student grades, and perform other record keeping tasks. Teachers' approval of the plan and specifically the teacher goal of using microcomputer technology was important for maintaining progress. Teacher approval of the school improvement plan would also indicate commitment to using microcomputer technology. In addition to this commitment, the principal generated a separate anonymous commitment form that referred specifically to technology and asked teachers to indicate their level of

commitment on a scale of 1-10. Table 8 shows results of teachers' commitment to technology at NHJ.

These results were viewed positively by the principal. A majority of the teachers responded affirmatively to the technology initiative. It was the belief of the principal (as change facilitator) that enough positive sentiment existed concerning technology that negative sentiment could be overcome. There was also the recognition by the principal that is captured in a statement by Durost (1994) who observed that teachers do not learn the same way, at the same pace, and neither do all teachers desire to be computer experts. The reluctance to change was recognized in those teachers that did not commit to the technology process.

As can be seen in Table 8, tabulation of classroom teacher responses yielded two not committed, two questionably committed, three generally committed, and eight committed to technology. Three classroom teachers did not respond to the survey and it was not required of them to do so. Seven of 25 instructional staff members that were not classroom teachers indicated commitment to technology.

Much of the summer of 1993 was spent obtaining hardware and software and placing them in the teacher workstation units. NHJ now had twelve Macintosh LC and five IBM PS/2

Table 8

Teacher Commitment to Technology at N. H. Jones, May 1993

Level of Commitment	Classroom Teachers	All Teachers
NOT COMMITTED	2	2
QUESTIONABLE COMMITMENT	2	2
GENERALLY COMMITTED	3	3
COMMITTED	8	15

Note: N=22

computers. These would form the basis of the redefined innovation. That there were 18 teachers and 17 computer workstations did not overly concern the principal. He was operating on the premise that not all teachers would use microcomputer technology. Over the summer, the principal installed WordPerfect version 5.1 on IBM microcomputers and version 2.1 on Macintosh microcomputers and Microsoft Works, Gradebook Plus, and Lesson Planner software onto the computers that teachers would use for wordprocessing, keeping student grades, writing lesson plans, and generating communications.

The Lesson Planner program was developed during the summer by the school's Elementary Learning Specialist after an extensive search for a commercial product suitable for

teachers' needs failed. The Lesson Planner was designed using WordPerfect software for the IBM and Macintosh microcomputers. (The Lesson Planner program has been modified by the Elementary Learning Specialist and now operates with Macintosh 3.0. The name was changed to Teacher Planner and contains several new features. This product is now available commercially.)

Two teachers experimented with Gradebook Plus during the 1992-1993 year. The Gradebook Plus program was designed by educators for educators and provided an easy method for keeping records using the microcomputer. The review by the teachers who used the Gradebook Plus program and their subsequent recommendation of the product was convincing enough for the principal to purchase both Macintosh and IBM site license versions. Some of the capabilities of Gradebook Plus are: (a) record student grades on selected evaluation measures, (b) word process, (c) prepare a report card for an individual student, (d) average grades of students, (e) print student progress reports, and (f) create a roster of students.

The way in which the technology initiative proceeded in 1993-1994 was different from the previous year. In 1992-1993 teachers were asked to use technology and given choices.

Before the 1993-1994 year began teachers made their requests known to the principal to reserve a microcomputer workstation for the beginning of the 1993-1994 school year. Microcomputer technology had taken root at NHJ and was being diffused.

From Committee to Learning Community

At the onset of the 1993-1994 school year, a number of personnel changes had occurred. The ITPC was especially hard hit with attrition of members to other endeavors. Of the eight members on the committee in 1992-1993 only four remained. The innovation, however, had been so clearly defined for teachers and the diffusion of microcomputer technology had so spread throughout the school, that the ITPC did not function during the 1993-1994 school year. The configuration components of the innovation and expectations were so specific that teachers could realistically embrace the innovation. The innovation had evolved from multiple technology devices to a manageable workstation configuration.

In retrospect, a statement made in the ITPC meetings in the summer of 1992 epitomized the key to success. It was a question of task size. By giving a student fifty words to spell on a test, one was not likely to get the response

expected. However, giving the student ten words to spell increased the likelihood that the student would meet the expectations (field notes, Dos 1, p. 54, VCR recording B, 1992). The ITPC had reduced the number of technology devices in eight categories to a single teacher microcomputer workstation; teachers were anxious to receive one and begin to use it.

Over the course of working with technology during the 1992-1993 school year, the majority of teachers were now well informed about technology and were ready to explore its possibilities. New teachers recommended for hire for the 1993-1994 school year were thoroughly briefed during the job interview about the NHJ technology initiative. They were asked about their technology background and expertise and if they were willing to be microcomputer technology users. The six new hires expressed a genuine interest in microcomputer technology and indicated a desire to have a teacher workstation available to them.

Teacher Training, 1993-1994

Up to the initial 1993-1994 microcomputer technology workshop, opportunities for teachers to learn to use technology had been limited. With the exception of an effort in 1992-1993 to familiarize teachers with capabilities of

the IBM computer lab, two Educational Management Group's AS 2000 inservices, and teachers using full and one half days to become familiar with their particular technology, teacher training suffered.

The training of teachers to use microcomputer technology was a very high priority for the 1993-1994 school year. There were at least two reasons for this. One, the teacher productivity advantage of using the Gradebook Plus program and the Lesson Planner programs were perceived as ways of enhancing teacher effectiveness. And two, microcomputer technology was written into the NHJ school improvement plan.

When school opened for the 1993-1994 year, the principal had prepared the teacher technology workstations and a workshop for teachers to enable the faculty to move immediately to using microcomputer technology. August 18, 1993, was an important day in that all teacher microcomputer workstations were set up in the media center for the initial technology workshop. The workshop covered a portion of the day and the excitement about microcomputer technology grew. Comments after the workshop were very positive and teachers remarked that they were excited about the programs and ready to start using them. Another inservice took place on

September 22, 1993. These two training sessions provided a foundation for teachers to use microcomputer technology in 1993-1994. From this point the principal and two key personnel (the Elementary Learning Specialist and the Media Specialist) provided assistance to teachers as need arose in the use of microcomputer technology.

Figure 2 shows teachers receiving training in microcomputer technology on September 22, 1994. The workshops on microcomputer technology were followed by the Education Management Group's (EMG) AS 2000 workshops for teachers. Two EMG workshops were held during the 1993-1994. One on November 17, 1993, and the other on January 20, 1994. These workshops supplemented the school sponsored training activities and served to promote teacher enthusiasm for microcomputer technology.

Because of teacher interest in microcomputer technology, two visits to Webster Elementary Model Technology school transpired in 1993-1994. In January 1994, ten teachers traveled to the school to make observations and to see technology in action. This experience allowed teachers a first hand look at technology in operation in another school.

The principal held great expectations that teachers who

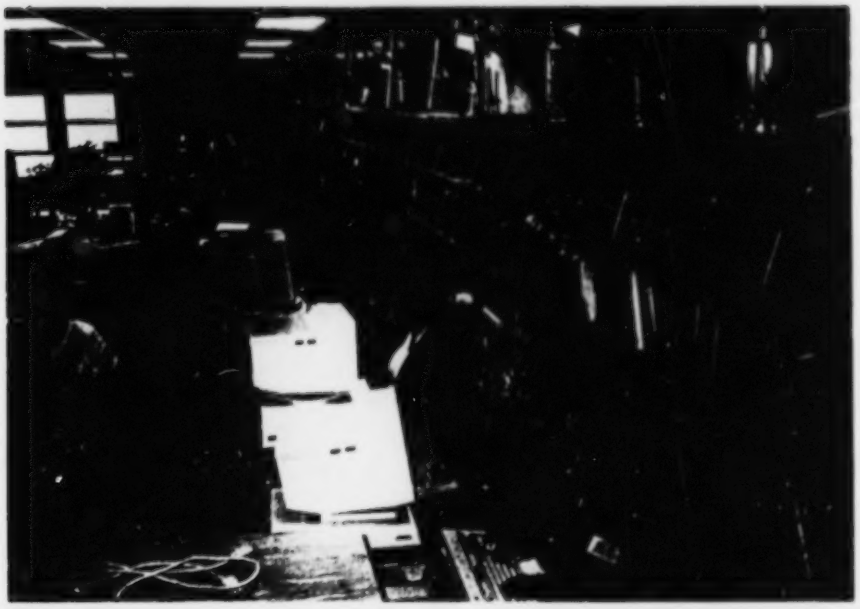

Figure 2. Teachers participate in microcomputer technology inservice, September 1993

visited Webster would spread the good news about what technology was doing for students in the model school setting. The sharing of the experience upon their return would serve as a catalyst to increasing teachers' affirmative response to microcomputer technology at NHJ.

On Wednesday, February 16, 1994, two more workshop sessions were provided to teachers. The first was a two hour session on the IBM computer lab (see Figure 3) and the network and the second was on multimedia capabilities in the media center.

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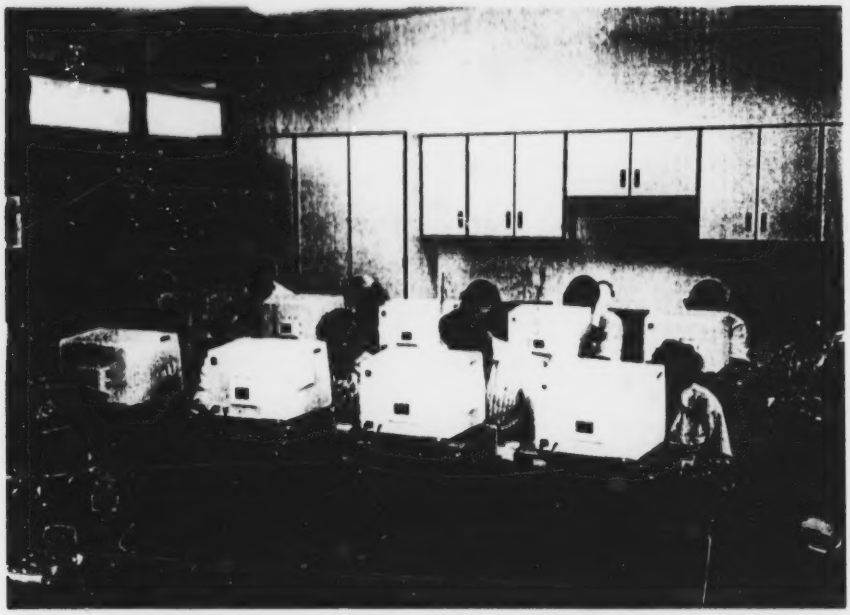

Figure 3. Teachers receive training in IBM lab, February 1994

Teacher Collaboration

On Thursday, March 7, 1994, two teachers approached the principal asking for a half day to work with microcomputer technology (field notes, Dos 3, p. 18, 1994). These teachers were from different grade levels and were brought together by microcomputer technology. This event confirmed Ray's (1991) observation that computers and related technologies generate reasons and ways for users to collaborate and work together. In this case, one teacher's expertise was being shared with another teacher who did not as yet have the background to successfully use microcomputer technology.

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Sandholtz and Ringstaff (1993) identified several benefits resulting from instructional technologies and teacher collaboration. Some of those benefits to teachers were camaraderie, enthusiasm and support. Figure 4 shows the two teachers collaborating with microcomputer technology. Figure 5 shows two other teachers collaborating in their use of microcomputer technology. These events were two examples of teacher collaboration taking place with microcomputer technology. Episodes of teacher collaboration were occurring all over the NHJ campus. Teachers were learning from other teachers.

The impact of collaboration among teachers can be understood in the statement of a teacher. When asked, "How did working with another teacher on microcomputer technology work out," she related that "It was great, I got to know a teacher a little better than I would have because of the computer (field notes, cassette recording 11.1, 1994)."

One of the research questions for this study was to identify factors in the school environment that promoted the diffusion and implementation of microcomputer technology by teachers. Teachers were asked to respond to questions concerning factors that promoted the diffusion and use of

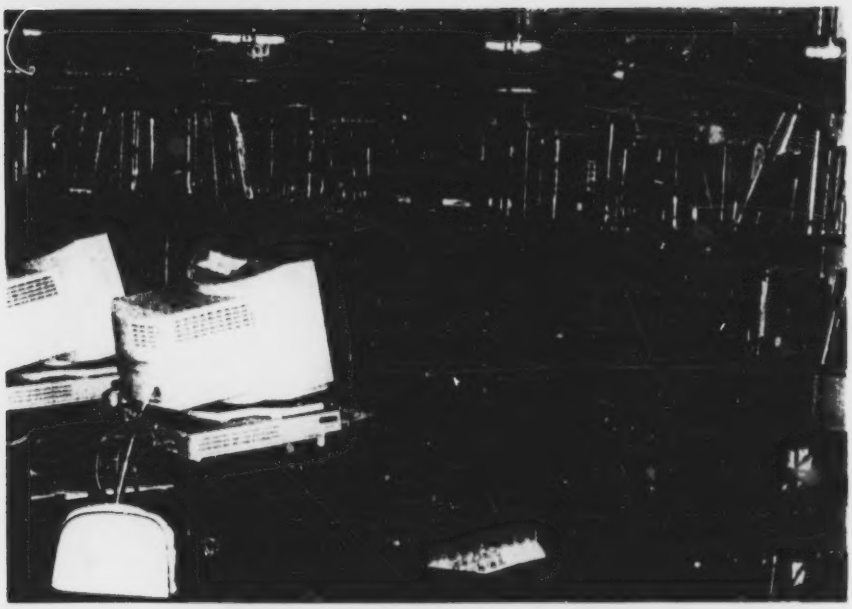

Figure 4. Two Teachers use half day to practice with Lesson Planner, March 1994

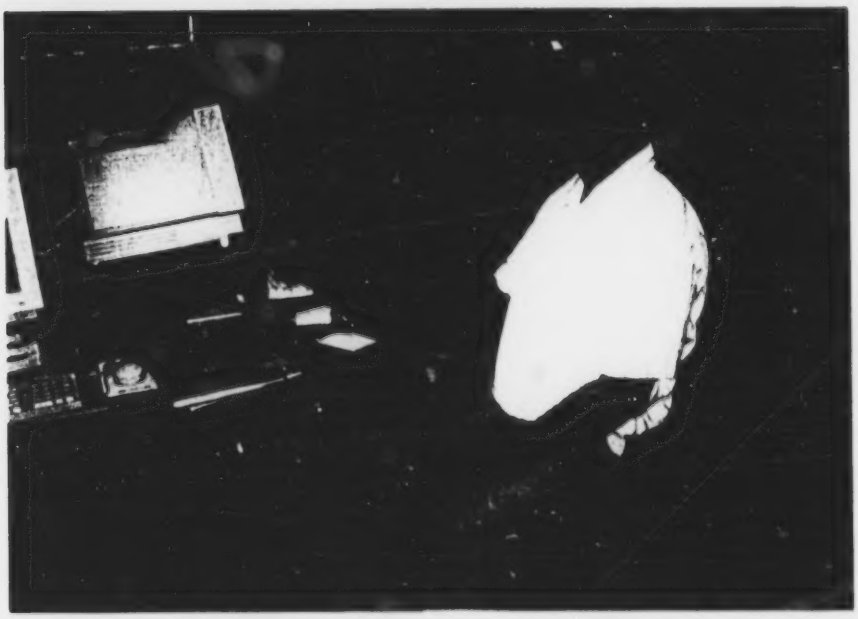

Figure 5. Teachers collaborate in learning to use microcomputer technology, March 1994

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technology at NHJ in both school years 1992-1993 and 1993-1994. The results of the survey are contained in Table 9. The availability of technology, training, release time, ease of use of the technology, and colleague assistance hold prominent places in teachers' responses. In relation to the aforementioned collaboration of teachers, Table 9 also shows the importance of colleague assistance in relation to other teacher perceived factors in the diffusion of technology for the 1992-1993 and the 1993-1994 school years.

Facilitating Change

The Change Facilitator strategy was used to foster the acceptance and use of microcomputer technology and assist in its implementation in the school environment. The interventions of game plan component one were primarily used in the initiation phase of the innovation's diffusion. The principal as change facilitator used making decisions, planning, preparing, seeking or providing materials, and providing equipment.

The principal made the decision that this change process for teachers would be unpressured and a decision was made to provide initial training for teachers early in the initiation of the innovation and the change process. Planning was engaged in by the principal as change

Table 9

Degree of Importance of Selected Factors Perceived by Teachers in the Diffusion and Use of Technology

Factors of Importance to Teachers	Dates	Very Important	Important	Somewhat Important	Not Important
Colleague Assistance	5/93	41%	53%	6%	
	5/94	60%	20%	20%	
Release Time	5/93	47%	47%	6%	
	5/94	54%	33%	13%	
Avail-ability of Technology	5/93	94%	6%		
	5/94	80%	20%		
Training	5/93	71%	24%	5%	
	5/94	60%	27%	7%	6%
Prior Knowledge of Innovation	5/93	18%	53%	24%	5%
	5/94	33%	47%	20%	
Risk Taking Attitude	5/93	29%	53%	18%	
	5/94	33%	47%	20%	
Ease of Use of Technology	5/93	47%	47%	6%	
	5/94	53%	34%	13%	
Amount of Time to Learn Innovation	5/93	41%	47%	12%	
	5/94	53%	40%	7%	

Note: N=17 5/93
N=15 5/94

facilitator in setting up the microcomputer technology workshops and providing the initial training needed for teachers to begin using microcomputer technology. It was necessary for the principal as change facilitator to be

prepared to provide technical assistance to teachers. In this intervention, the principal had to read the manuals that supported use of both models of microcomputers and printers and understand how to use the software. Seeking and providing materials was a periodic need of teachers in their use of microcomputer technology. To keep teachers using microcomputer technology with minimum frustration, floppy disks, computer paper, and ribbons were available for teachers to have when needed.

The interventions of game plan component two identified earlier provided a framework upon which the researcher could promote the use of microcomputer technology by teachers. The change facilitator used developing positive attitudes, holding workshops, modeling/demonstrating innovation use, observing innovation use, and providing feedback on innovation use. The principal scheduled workshops to train teachers to use the innovation appropriately. Teachers were encouraged verbally and provided small tokens of appreciation when incremental gains in using microcomputer technology were noted. And users of microcomputer technology received positive feedback when hard copy documents were produced using microcomputer technology. There were some specific opportunities with teachers and microcomputer

technology occurring during the 1993-1994 school year that the principal capitalized on to facilitate the use of microcomputer technology and promote the change process. These opportunities were faculty meetings, grade level meetings, leadership team meetings, and individual teacher conversations.

The use of microcomputer technology was done in large part on an individual scale. The principal along with two key persons, the Elementary Learning Specialist and the Media Specialist, were important resources in assisting and encouraging teachers to use microcomputer technology.

The school principal provided training activities for teachers, observed the innovation in action, modeled the innovation, provided feedback for encouragement, and fostered positive attitudes toward the innovation. By appreciating the efforts that teachers were putting into microcomputer technology and acknowledging their involvement, the principal was the change facilitator reinforcing continued use of microcomputer technology (field notes, cassette recording 8.8, 1994).

Game plan component three--consultation and reinforcement--was a continual intervention employed by the facilitator. Encouraging teachers one-to-one was done

frequently and on a large scale. Teachers were praised immediately when they were observed using microcomputer technology. In many instances, sidewalk conversation was employed to praise teachers for using microcomputer technology and to encourage them to continue. Office visits by teachers were not allowed to end without alluding to microcomputer technology and assessing teacher progress and problems.

The Elementary Learning Specialist was a consistent source of help and encouragement to teachers in that frequent visitations were made to classrooms and teachers readily sought her assistance in using microcomputer technology. As creator of the Lesson Planner program, she was able to provide immediate technical assistance in all facets of program use. As one knowledgeable in microcomputer technology she was a key informant on many events of teachers using microcomputer technology that the researcher was not able to view.

The Media Specialist helped facilitate the use of microcomputer technology by setting up a teacher workstation in the media center to assist teachers with using Gradebook Plus and Lesson Planner (see Figure 6). Her positive attitude and effort to diffuse microcomputer technology

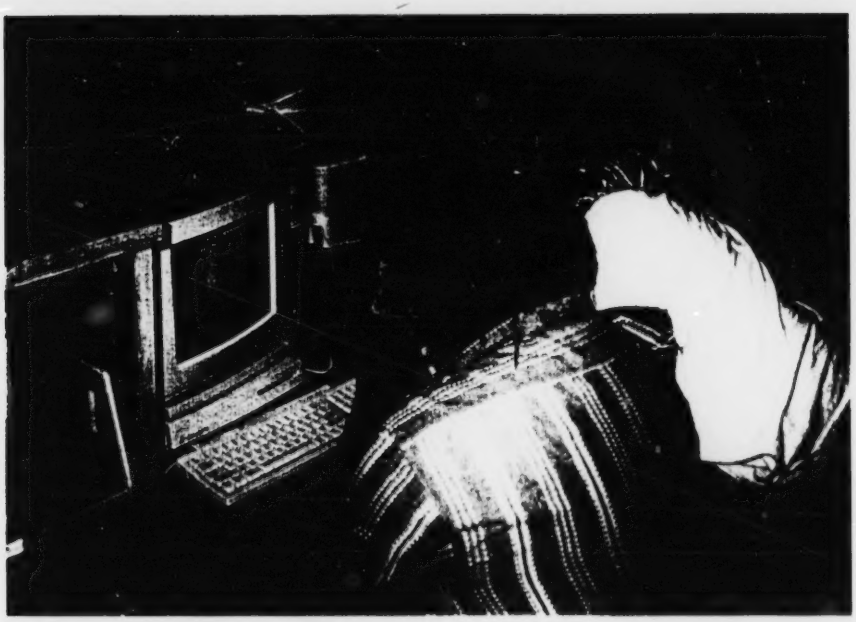

Figure 6. Technical assistance provided to teacher by Media Specialist, November 1993

throughout NHJ was evident in conversation with the researcher and in observations of her work with colleagues.

Seven interventions of game plan component four were used in facilitating change. They were encouraging people on a one-to-one basis, promoting innovation use among small groups, assisting individuals in solving problems, providing personalized technical assistance, holding brief conversations and applauding progress, reinforcing individuals' attempts to change, holding brief conversations and applauding progress, and celebrating small successes.

On September 20, 1993, the principal had an opportunity

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to encourage a small group of teachers working in the media center. These teachers had not originally requested a microcomputer workstation but sufficient positive information about the innovation had spread that they had become interested. The principal interacted for a few minutes with the group and reinforced their use of microcomputer technology giving praise for their efforts to make it a part of their professional repertoire.

On September 28, 1993, Ms. Hill entered the principal's office smiling and holding a computer printout in her hand. She indicated that these were her lesson plans for the week and she had completed the task by herself and that she was proud of herself for the accomplishment (field notes, Dos 3, p. 14, 1993). The principal acknowledged the work of Ms. Hill and praised her accomplishment too. He purchased a soft drink for the teacher and later placed a congratulatory note in her box for her work with microcomputer technology.

Events like these occurred over the course of the 1993-1994 school year where teachers were observed in the act of using microcomputer technology or teachers would voluntarily share a success story with the principal. It was not uncommon for a teacher to find fifty cents for a drink from the drink machine in his or her mailbox after a

microcomputer technology success story.

There were also numerous opportunities to assist teachers using microcomputer technology during the year. These occasions were used to provide assistance and encouragement. These were welcomed times because it gave the researcher an opportunity to monitor how well teachers were progressing with microcomputer technology.

Faculty meetings were opportune times for the principal to openly praise teachers for using microcomputer technology. These large group sessions afforded the occasion to publicly acknowledge teachers using microcomputer technology. It was hoped that this overt praise would prompt other teachers to pay more attention to microcomputer technology thereby increasing their use of the innovation.

Monitoring Microcomputer Technology Use

Game plan four, monitoring as mentioned earlier was executed through the CBAM Stages of Concern and Level of Use interviews. Results based on these instruments will be discussed in Chapter 6. In addition to the CBAM instruments, another method utilized to monitor use of microcomputer technology was through collection of physical artifacts. During the 1993-1994 school year, teachers were requested to turn in to the principal copies of lesson plans and

student's grades. These could be readily printed by teachers from the workstations if the data had been entered into the computer. Teachers were asked to print hard copies of these artifacts four times during the course of the 1993-1994 school year. These requests corresponded with the four grading periods of the school year. The response by each teacher to the request to turn in the documents was an indication of the consistency of use by teachers and the relative ease with which each teacher was experiencing microcomputer technology. During these times the principal as researcher observed the elapsed time between the request and actual receipt of the artifacts. Those teachers turning in the artifacts shortly after the announcement coincided with a higher degree of use obtained by the teacher. Those teachers who took longer to turn in the documents were interpreted as having more difficulty in using microcomputer technology. These observations agree with the Level of Use data collected from NHJ teachers.

Celebrating Success

The culminating activity for the success of computer technology at NHJ was the "TechnoBash" (see Figure 7). This term was coined by Ms. Burnes, a fourth grade teacher who served on the school leadership team. Early in the school

Figure 7. The NHJ "Technobash", May 1994

year it was mentioned by the principal in a leadership team meeting that a party would be given to recognize the success of the initiative of computer technology owing to teachers embracing it.

On May 11, 1994, the "Technobash" was held in the media center to show appreciation for teachers and their success in working with computer technology. At the close of the gathering, all teachers were presented with certificates of achievement in educational technology.

Summary

Implementation of an innovation is a difficult task.

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The field of education is littered with the cycle of introduction of an innovation, evaluation of the innovation, and rejection of the innovation (Hord et al., 1987).

Commitment of teachers to utilize an innovation is an important step in the adoption process. A survey was used to assess the level of teacher commitment to using technology at NHJ. Results indicated a majority of teachers were committed to using technology. The advancement of the change process and teachers use of microcomputer technology began with a small group of interested and motivated teachers. As the innovation diffused in the school environment, other teachers began to accept microcomputer technology and began to use it in the classroom. A key factor in the diffusion of microcomputer technology was colleague assistance. This activity was viewed as a necessity to sustain teacher commitment to microcomputer technology. In the case of NHJ, access to microcomputer technology and colleague assistance were major promoters of the initiative and kept the commitment alive.

There were some specific interventions that the change facilitator used in 1993-1994 to promote microcomputer technology with teachers. Training along with encouragement, praise, and technical assistance were all ingredients in

successfully embedding the innovation in the school.

Microcomputer technology was envisioned as an instructional management tool that would assist teachers to increase their personal productivity by decreasing the amount of time spent on routine tasks and by providing an easy way of writing and recording lesson plans and maintaining student grades. The time saved would be channeled by teachers into other areas of the teaching responsibility. This factor was an important element in turning teachers to microcomputer technology.

The change process which involved teachers using the microcomputer workstation was monitored by the principal as researcher through participant observation and instruments of the CBAM. Results showed evidence that teachers were using the innovation. The success of diffusing microcomputer technology in the school environment and with teachers was important to the school, teachers, and researcher. At the end of the 1994 year, the success of teachers' use of the innovation was celebrated with the "Technobash", an affair designed to recognize teachers and their commitment to microcomputer technology.

CHAPTER 6

STAGES OF CONCERN AND LEVEL OF USE OF MICROCOMPUTER TECHNOLOGY OF TEACHERS AT N. H. JONES ELEMENTARY

CBAM Instrumentation and Data Collection

The Concerns-Based Adoption Model (CBAM) is a tool that is useful when an innovation is being introduced. CBAM has three dimensions, Innovation Configuration, Stages of Concern, and Levels of Use. These dimensions can be used to successfully implement an innovation in an organization. In this study, the Innovation Configuration dimension was used to simplify the innovation, microcomputer technology, into eight component parts for a teacher workstation. The Stages of Concern dimension was used to ascertain teachers' concerns about microcomputer technology, and the Levels of Use dimension was used to assess the degree of teacher use of microcomputer technology.

Hord et al. (1987) made the following observations about Levels of Use and individuals involved with a particular innovation.

1. People tend to move sequentially from Level 0 (Nonuse) to Level IVA (Routine). Everyone involved with an innovation

generally moves from a nonuse level to a user level.

2. Research using the Levels of Use dimension of CBAM indicates that for most innovations, users will attain Level IVA (Routine) and remain there (Loucks et al., 1975).

3. It is possible for individuals to move from Level IVA; however, few users reach Level IVB (Refinement) and in rare instances will a user reach Level VI.

4. Level of Use data can reveal problems of implementation of an innovation. Level 0 (Nonuse) through Level II (Preparation) are nonuse levels. Nonuser levels prevalent in the user profile are cause for anxiety in organizations because the data reveal minimal use of the innovation.

5. Levels III through VI are user levels and when these are prominent in user profiles of an organization, it is an indication that the innovation is being practiced by individuals.

The researcher received training in the CBAM Level of Use dimension during a two day workshop in November 1993 in order to appropriately administer the LoU protocol and assign a level of use to each teacher.

Stages of Concern Questionnaire Pilot Study

The CBAM Stages of Concern Questionnaire (SOCQ) was piloted in February 1993. This was an early release day and

district schools were engaged in school improvement activities related to Blueprint 2000 goals. A portion of the meeting was utilized to assess teacher concerns about technology with the SOCQ. The SOCQ identified concerns of individuals as reflected in three dimensions--Self, Task, and Impact. These concerns are further delineated into stages. Stage 0 (Awareness), Stage 1 (Informational), and Stage 2 (Personal) are the self-concern stages. Hord et al. (1987) reported that individuals are likely to have self-concerns in the early stages of a change effort. Task concerns (Stage 3--Management) become evident during use of the innovation by individuals and Stages 4 (Consequence), 5 (Collaboration), and 6 (Refocusing) are Impact stages. Impact concerns become intense as individuals deepen their understanding of the innovation and begin to ponder its effect on clients and what can be done to improve the effectiveness of the innovation (Hord et al., 1987).

The SOCQ is a 35-item measure that can be hand scored or scored by computer. Teachers at NHJ did their own scoring at each administration of the questionnaire. The interpretation of the scores was done by the principal (researcher) and results of the SOCQ were reported to teachers on a later date. Each teacher received a private

individual analysis and interpretation. Generally speaking, interpretations of profiles can be based upon the concerns stage with the highest score (Hord et al., 1987). At NHJ teachers' concerns were interpreted using the highest and second highest scores on the SOCQ (see Appendix F for Stages of Concerns interpretations).

Teachers were informed by the principal at the time of their individual SOCQ analysis that concerns were neither positive nor negative. Rather, the SOCQ is intended to be diagnostic and is not a screening instrument. Because a teacher is on a higher Stage of Concern does not indicate the teacher is better, only the needs for assistance are different (Hord et al., 1987).

Table 10 shows a faculty cross section of NHJ teachers' highest and second highest Concerns and the percent of teachers at each Stage of Concern in February 1993. The table presents data for three different subgroups: the Elementary Learning Specialist and Media Specialist; the four members of the ITPC; and 13 classroom teachers. Hall et al. (1986) indicated that the simplest interpretation of the SOCQ is to identify the highest stage score. An in-depth interpretation can be obtained by examining both the highest and second highest scores.

Table 10

Percentage of Highest and Second Highest Concerns of Teachers by Stage of Concern, February 1993

	Number of Teachers		Stages of Concern						
			0	1	2	3	4	5	6
ELS & Media Specialist	2	Highest						50%	50%
		Second Highest			50%			50%	
ITPC	4	Highest	25%		50%	25%			
		Second Highest			25%		25%	25%	25%
Teachers	13	Highest	31%	39%	15%		15%		
		Second Highest	23%	23%	38%	8%	8%		

Teachers on the ITPC were expected to be role models for other teachers at NHJ and in that capacity were to lead by example. One of the examples was to be users of technology. Given that concerns are developmental, and individuals move differently through concerns, an interpretation of highest and second highest scores for ITPC teachers and other teachers gives evidence that ITPC teachers were moving from self-concerns toward Management and Impact concerns ahead of other classroom teachers. A similar relationship can be drawn between the ELS and Media Specialist and ITPC teachers.

As can be seen in Table 10, of the 17 teachers involved in the pilot, 14 had high scores in the self-concern stages of Awareness, Informational, and Personal reflecting early stages of change and nonuser status. One teacher had a high score in Stage 3 (Management) and two teachers had high scores in the Consequence stage.

Figure 8 presents the mean percentile scores for teachers on the Stages of Concern pilot in February 1993. The early change state and nonuser profile represented by high scores in the Awareness, Informational, and Personal stages are prominent in the graph. The profile generated by NHJ classroom teachers in the pilot test showed a majority of teachers having self concerns and conforming to the nonuser profile (see Appendix G, Table 16 for Teachers' Stages of Concern Mean Percentile Scores for Instructional Technology). Teachers with task or impact concerns can be identified by their high scores on the Management and Consequence stages.

One teacher, Ms. Vance was a member of the ITPC and had a high score in Stage 0 (Awareness). Ms. Arvin and Ms. Jordan were members of the ITPC and had high scores in the Personal and Management stages respectively. Ms. Olsen and Ms. Ingram had high scores in the Consequence stage. These

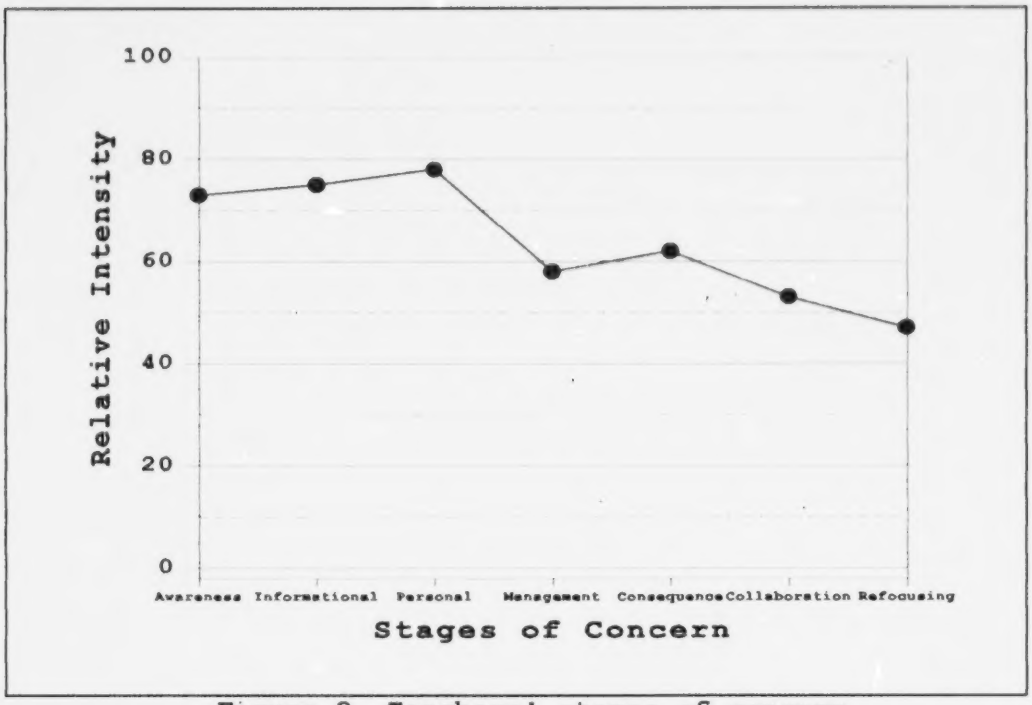

Figure 8. Teachers' stages of concern unit profile, February 1993

teachers were collaborating with ITPC teachers in their use of microcomputers (field notes, 1993).

Ms. Ranier was interpreted as having an "extreme response tendency." This response pattern suggests a lack of ability or unwillingness to discern between the sources of concern about the innovation or it can suggest great anxiety relative to the innovation (Loucks et al., 1975).

For the pilot test of the SOCQ, five classroom teachers had high Stage 0 (Awareness) scores. Stage 0 has two distinct meanings. For the user, a high Awareness score

indicates an absence of concern about the innovation. For nonusers, a high Awareness score indicates awareness of and concern about the innovation.

Five teachers had high Informational scores. Stage 1 high scores are indicative of intense concerns about what the innovation is and what use of the innovation involves. Individuals at Stage 1 are interested in more descriptive information about the innovation.

Four teachers evidenced high Stage 2 (Personal) concerns. Personal concerns indicate ego-oriented questions and uncertainties about the innovation. Status, reward, and effects of the innovation on the individual are prominent at this stage.

One teacher's concern was reflected at Stage 3 (Management). This stage is exemplified by concerns of management, time, and logistical aspects of the innovation. It is worth noting that this teacher was using the microcomputer workstation provided by the school district. And two teachers had high Stage 4 (Consequence) concerns. Consequence concerns are connected to individual concerns about the impact of the innovation on the individual and students.

Other key personnel like the Elementary Learning

Specialist (ELS) and the Media Specialist had high Collaboration scores and Refocusing scores respectively (see Table 10). The second highest score for the ELS was in Stage 2 (Personal) and the Media Specialist's second highest score was in Stage 5 (Collaboration). One of the characteristics of collaboration high score individuals is that their strength can be used to provide technical assistance to others in the organization. For Refocusing high score individuals, they are to be encouraged to act on their concerns to improve the innovation. Over time, however, these two individuals performed activities different from their stage characteristics. The Elementary Learning Specialist refined the Lesson Planner program to improve its capabilities for teachers and the Media Specialist became more of a technical assistance person by setting up a microcomputer workstation in the media center to assist teachers in learning to use microcomputer technology.

September 1993 Administration of Stages of Concern Instrument and Results

Prior to the beginning of the second semester of the 1993-1994 school year two teachers were lost from the study. Both teachers were in fourth grade. One resigned upon return from winter break and the other teacher requested and was granted leave of absence. Data from the ELS and Media

Specialist were not included because of their differing roles from classroom teachers. They did not have traditional classrooms, write daily lesson plans or record grades for students. These individuals were available to assist classroom teachers in using microcomputer technology. Given these circumstances, CBAM data were collected from 16 teachers during 1993-1994 school year.

In September 1993, the SOCQ was administered to the instructional staff of NHJ. The innovation had evolved and was now configured as a microcomputer workstation having eight component parts. Table 11 shows the highest and second highest concern and percent of teachers at each Stage of Concern for the September 1993 administration of the SOCQ. As can be seen in Table 11, teacher self-concerns and the nonuser pattern are again noticeable with 11 teachers having high scores in the Awareness, Informational and Personal Stages of Concern. Four teachers had high scores in Stage 0 (Awareness). The scores of three of these teachers was corroborated through researcher observation of nonuse of microcomputer technology by these teachers. Three of the teachers in the Awareness stage did not request a microcomputer workstation for the 1993-1994 school year. The 1993-1994 school year was well under way when two of these

teachers attempted to use microcomputer technology. Five teachers had high scores in the Informational stage reflecting a need to know more about microcomputer technology. Of the five teachers in Stage 1, three were

Table 11

Percentage of Highest and Second Highest Concerns of Teachers by Stage of Concern, September 1993

	Number of Teachers		Stages of Concern						
			0	1	2	3	4	5	6
Teachers	16	Highest	25%	31%	13%	31%			
		Second Highest	37%	12%	13%	13%	25%		

first year teachers at NHJ. One teacher, Ms. Olsen, had indicated to the principal before the start of the year that she wanted to become a user of Gradebook Plus. Ms. Roberson had made a previous attempt at using the microcomputer but reconsidered. Two teachers' concerns were identified in high scores on Stage 2. Both were in fifth grade--one a veteran teacher and one a first year teacher. Five teachers had Stage 3 (Management) concerns. Four of these teachers were recent graduates having four or less years of teaching experience. ITPC discussions pointed out that background of teachers made a difference in their use of technology in the

classroom (field notes, Dos 1, p. 22, VCR recording A). It was noted that teachers with more recent college or university experiences were more likely to have had exposure to microcomputers and were less afraid of using them.

The concerns teachers had in relation to microcomputer technology in September 1993 can be identified from the scores listed in Table 17 (see Appendix H, Table 17, for Teachers' Stages of Concern Mean Percentile Scores for Microcomputer Technology, September 1993). Figure 9 displays the mean percentile scores of teachers for the September 1993 administration of the SOCQ. The early change state and nonuser profile represented by high scores in the Awareness, Informational, and Personal Stages of Concern are prominent in the graph.

The principal as researcher recognized the early change state and concerns of the majority of teachers as clustering in Stages of Concern 0, 1, and 2. This clustering of concerns by teachers was evident in highest and second highest scores. Based upon the results of the September 1993 administration of the SOCQ, there was an intentional effort by the principal to supply teachers with information about microcomputer technology and encourage teachers to practice using the microcomputer workstation. These interventions

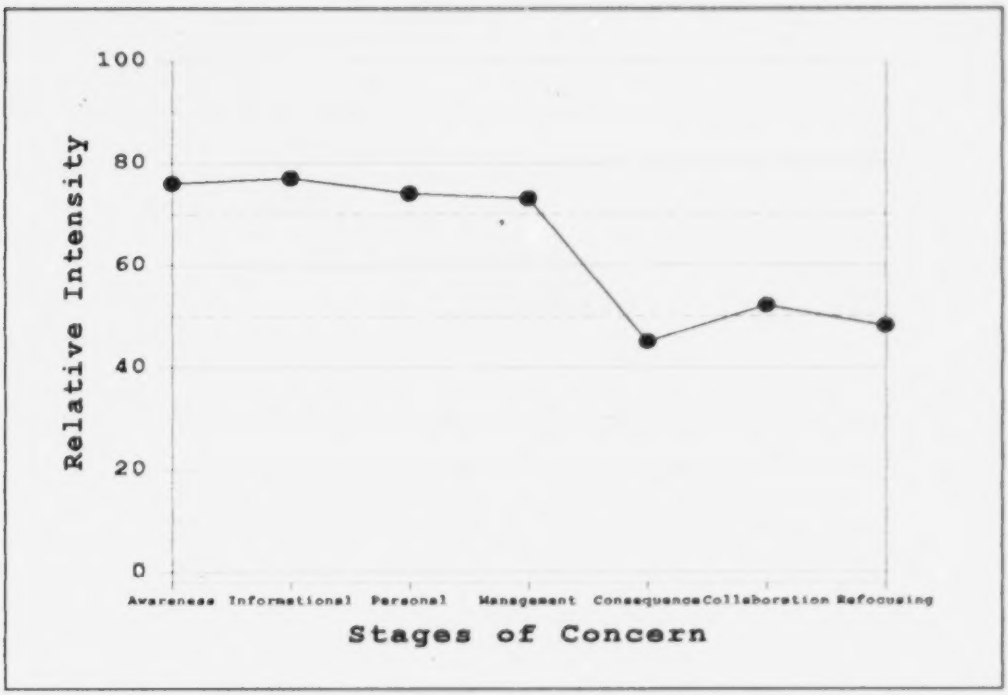

Figure 9. Teachers' stages of concern unit profile, September 1993

were perceived by the principal as reinforcers that would contribute to teachers' acceptance and use of the innovation. Teacher concerns for awareness and information about microcomputer technology were addressed through workshops and individual help sessions. Conversations were held to encourage teachers about how the microcomputer workstation made the work of the teacher easier and move teachers beyond the early change state and into the higher Stages of Concern. The strategies of one-to-one encouragement, modeling, coaching small groups in innovation

use, and providing practical assistance were interventions used by the change facilitator in the early change state of teachers' use of microcomputer technology.

Providing adequate technical assistance to teachers was of prime importance in the early phase of adopting microcomputer technology. In one instance, and corresponding directly to a teachers' highest concern score (Stage 1--Informational), the principal as change facilitator worked with Ms. Brown to overcome a problem associated with using the Lesson Planner program and printing documents from the microcomputer (field notes, 1993). In another instance, the principal conversed with Ms. Roberson who had a high Stage 2 score (field notes, 1993). In this conversation the principal provided specific information about microcomputer technology and how it could make the routine work by the teacher less time consuming. Similar conversations were engaged in with Ms. Oakes and Mr. Reaves. These teachers had high scores in the Informational Stage of Concern and assistance was provided to them based upon their stage of concern need.

Five teachers had highest concerns in Stage 3--Management. Three of these teachers were in fourth grade and two were in the third grade. Four of these teachers were

recent university graduates with four or less years of teaching experience but familiar with using the microcomputer. Teachers with management concerns were allowed to carry the teacher workstation home allowing them to increase their time practicing use of microcomputer technology.

May 1994 Administration of Stages of Concern Instrument and Results

The SOCQ was administered again to teachers in May 1994. Results confirmed that concerns of teachers about innovations are not entrenched. As teachers use an innovation the concerns they have about it change. Hord et al. (1987) reported that concerns are influenced by the feelings of those involved with an innovation, the perception of their ability to use the innovation, the environment in which the change occurs, the amount of other changes of which they are a part, and greatest of all, the kind of support and assistance received during the change process. Movement from one Stage of Concern to another Stage of Concern by teachers involved with an innovation cannot be forced (Hord et al., 1987). Movement, however, can be aided and assisted.

As can be seen in Table 12, analysis of results of the second administration of the SOCQ found no teacher to have a

high Stage 0 (Awareness) score. In comparison with September 1993 data, all five teachers evidencing high Awareness stage scores had moved to another concern. Three teachers were now indicating high Stage 1 (Informational) scores in comparison to five teachers in September 1993. Three teachers were now at Stage 2 (Personal) concern in comparison to two teachers at this stage in September 1993. One teacher was at Stage 3 in May 1994 compared to five teachers at stage 3 in September 1993. Six teachers had advanced to Stage 5 (Collaboration) and three teachers were evidencing highest concerns at Stage 6 (Refocusing).

Researcher observations of teachers using microcomputer technology agree with SOCQ scores of the teachers at the Self and Impact stages. The six teachers at Stage 5 were particularly confirmed by researcher observation (field notes, 1994). All were collaborating with other teachers in their use of microcomputer technology. It was difficult to corroborate the SOCQ findings of the teachers with high scores at stage 6 (Refocusing) by observation. One of the characteristics of the refocusing individual is that the person is considering replacing or modifying the existing innovation. Table 12 shows the percent of teachers highest and second highest concerns at the end of the 1993-1994

Table 12

Percentage of Highest and Second Highest Concerns of Teachers by Stage of Concern, May 1994

	Number of Teachers		Stages of Concern						
			0	1	2	3	4	5	6
Teachers	16	Highest		18%	19%	6%		38%	19%
		Second Highest	13%	25%	43%		13%	6%	

school year. At this point in the study, teachers had experienced one school year of the innovation configured as a micrcomputer workstation. Interpretation of highest and second highest teacher concern scores point to the developmental nature of their concerns. From September 1993 to May 1994 there was movement from the Self concern stages toward the Management and Impact stages of concern. This movement of teacher concerns is consistent with research on Stages of Concern (Hall et al., 1986). Teachers second highest scores follow a similar pattern for highest concern scores. These scores support the developmental hypothesis and highest concern data on movement of teacher concerns to other stages.

Two of the three teachers evidencing highest scores in the Personal concerns stage were veteran teachers with 10 or

more years experience. The third teacher was a beginning teacher. Five of the six teachers evidencing second highest intense concerns in Stage 2 were teachers with four or less years of experience. All five of these teachers had highest scores in the Collaboration stage. Two of the three teachers having highest Stage 1 scores in May 1994 were teachers who did not request a microcomputer workstation for the 1993-1994 school year.

Teachers SOCQ mean percentile scores for microcomputer technology in May 1994 can be identified in Table 18 (see Appendix I, Table 18 for Teachers' Stages of Concern Mean Percentile Scores for Microcomputer Technology). Figure 10 displays the mean percentile scores for the May 1994 administration of the SOCQ. Evident in the graph are higher scores of teachers in the Impact concerns represented in Stages 4, 5, and 6 and lower scores by teachers in the Self concern stages Awareness and Information. Teachers continued to have a high mean percentile score for the Personal Stage of Concern. The May 1994 administration of the SOCQ revealed six teachers evidencing high Awareness, Information, or Personal self concerns. One teacher expressed Stage 3 (Management) concerns, and nine teachers indicated Impact concerns. Considering the highest concerns

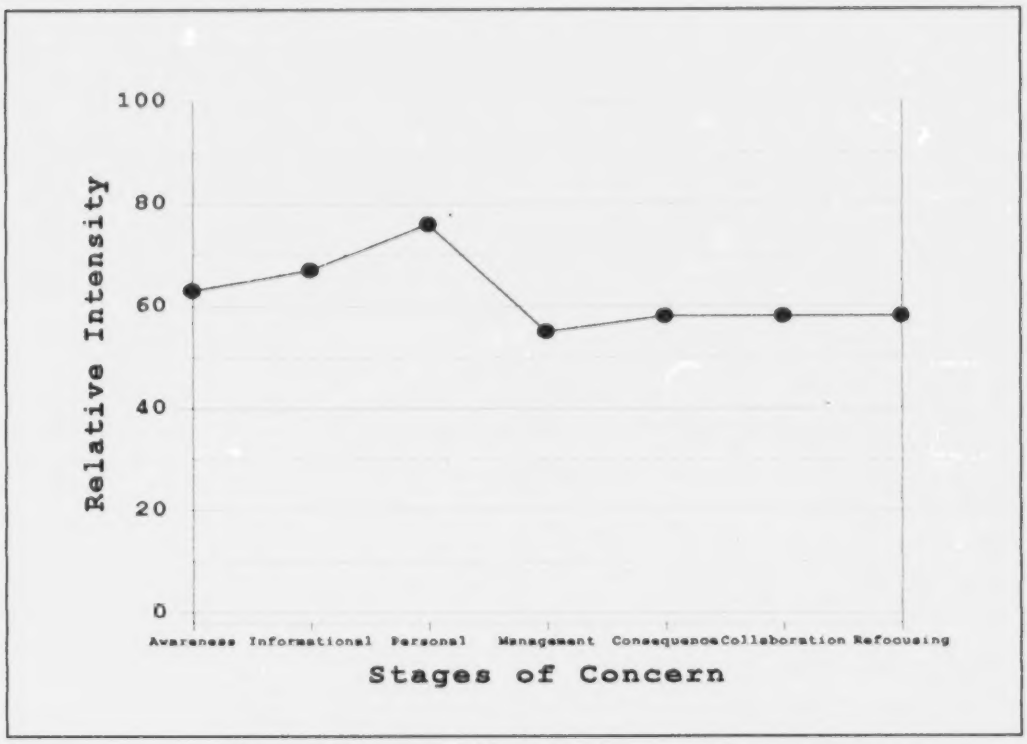

Figure 10. Teachers' stages of concern unit profile, May 1994

of teachers, Awareness, Informational, and Personal concerns were still prominent in the change process for teachers.

Figure 11 is an adaptation of the hypothesized movement of individuals associated with innovations and is taken from Hord et al. (1987). The graph identifies three types of users and traces the concerns of each type of user. Hord et al. (1987) hypothesized the movement of nonusers and inexperienced users' concerns on the Stages of Concern to

decrease in Stages 0, 1, and 2 and increase in Stages 4, 5 and 6. The unit profile for NHJ followed the hypothesized pattern. Teachers, however, continued to have a high mean percentile score for the Personal Stage of Concern. A possible explanation for this score is that teachers were still in the early change state and questions of status and reward as well as uncertainties about the innovation were still a focus of attention. Peer pressure to use microcomputer technology was present too. Status as user or nonuser of microcomputer technology was perhaps a factor in teachers' emotions.

Figure 12 presents the one year movement of teachers' concerns as measured by the SOCQ. The graph reflects the mean scores of teachers on the SOCQ for the September 1993 and May 1994 administrations. Evident in the graph is the increase from fall 1993 to spring 1994 in teachers' scores at the Impact stages Consequence, Collaboration, and Refocusing. There is also a noticeable decline at stage 3--Management.

Individuals involved with innovations and change progress differently. After a year of involvement with microcomputer technology it was apparent that teachers were in the early stages of the change process. One of the

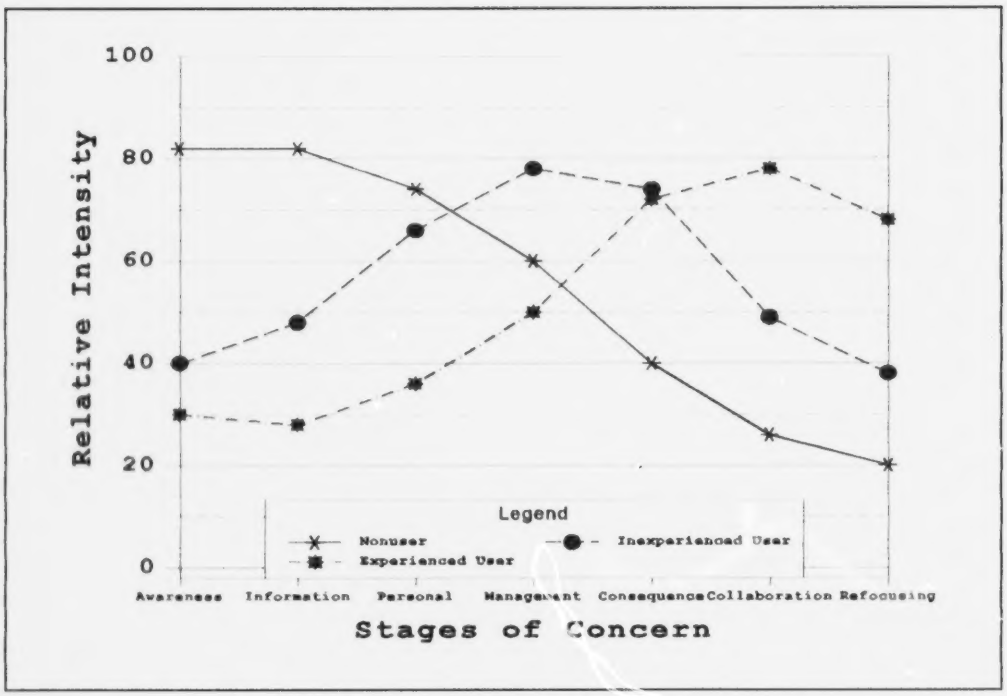

Figure 11. Hypothesized changes in teachers' concerns

conclusions reached in ITPC meetings was that getting involved with technology would be a process and not an overnight event. The ITPC believed that it would take three to five years for all teachers to become thorough and consistent users of technology. Results of data collected through instruments and observations made by the researcher uphold that time frame for the change process.

Level of Use Results for December 1993 and May 1994

The Level of Use dimension of CBAM focuses on

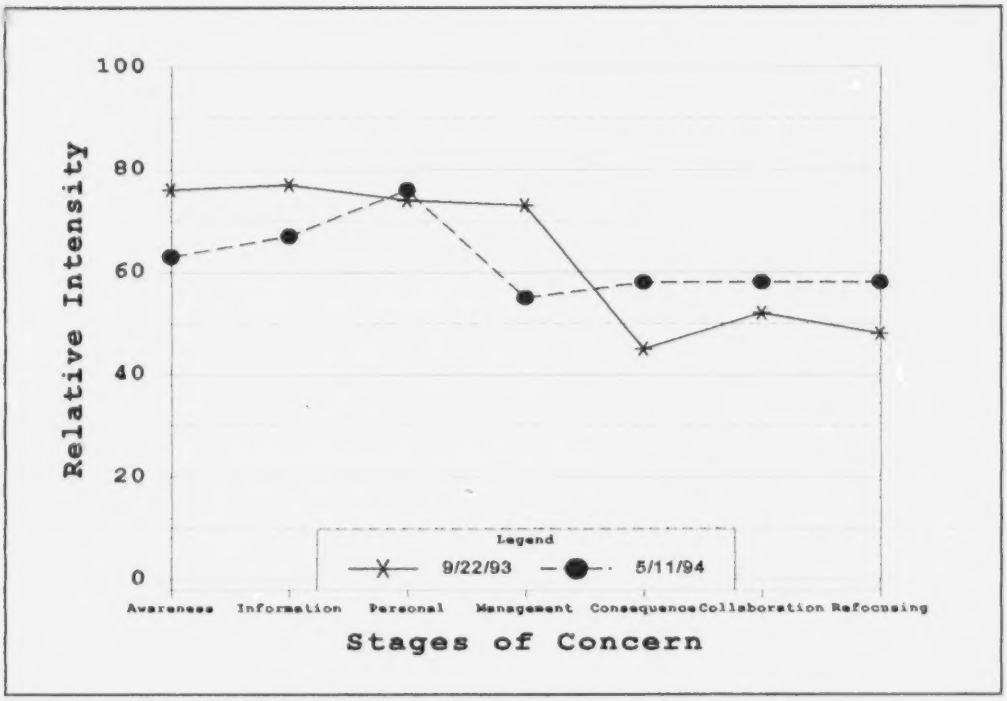

Figure 12. Changes in teachers' concerns, 1993-1994

performance (Hall et al., 1986). The LoU is an attempt to define operationally what the user is doing in relation to the innovation (Hord et al., 1987). The focused interview is the procedure used to measure an individual's LoU (Loucks et al., 1975). The main objective of the LoU interview is to gather enough information from the study participants to be able to assign a Level of Use (Loucks et al., 1975).

At the start of the 1993-1994 school year, classroom

teachers appeared to be nonusers corresponding with Level of Use I (Orientation) and Level of Use II (Preparation) for the innovation configured as a microcomputer workstation. Level of Use data were obtained from teachers in December 1993 and May 1994. For the first administration, teachers had interacted with microcomputer technology for approximately three months prior to interviews being conducted. There was a four month period of time between the first and second administrations of the LoU. Changes in teachers' level of use of microcomputer technology were observed and documented for the two time frames.

With permission of teachers, all interview tapes were sent to an independent CBAM trained specialist for assignment of an LoU and to obtain interrater reliability. There were no differences in assigned LoU's by the researcher and the CBAM specialist for the December 1993 and May 1994 administrations.

Table 13 shows the percent of NHJ teachers at each Level of Use with microcomputer technology for December 1993 and May 1994. Levels of Use 0 (Nonuse), I (Orientation), and II (Preparation) are nonuser levels. Levels III (Mechanical) through level VI (Renewal) are user levels.

As can be seen in Table 13, by December 1993 seven of

16 (44%) teachers had reached Level IVA (Routine) in their use of the microcomputer technology. These teachers had stabilized their use of the microcomputer technology and were not expecting to make any changes concerning their use of it (field notes, cassette recordings 1, 3, 4, 6, 9, 10, and 13, 1993). Six of 16 (37%) teachers had reached Level III (Mechanical). The Mechanical user was still trying to master the innovation. Teachers in Level III were continuing to learn about the innovation and its functions. Two teachers were at Level II (Preparation), the state of making a decision to become a user and one teacher was at Level I (Orientation), the state in which the individual is gathering information about the innovation.

Lesson plans and student grade printouts were collected from teachers four times during the 1993-1994 school year. These data collection times corresponded to the four nine week grading periods of the school year. These documents were not collected more frequently because the principal decided to give teachers time to learn to use the innovation and not create an atmosphere of pressure to produce printouts. As can be seen in Table 13, four teachers (25%) responded to the request to turn in computer generated lesson plans and seven teachers (44%) turned in printouts of

Table 13

Teachers Level of Use of Microcomputer Technology, 1993-1994

	Levels of Use							
	LoU 0	LoU I	LoU II	LoU III	LoU IVA	LoU IVB	LoU V	LoU VI
Date								
12/93		6%	13%	37%	44%			
5/94			19%	25%	50%	6%		

Note: N=16

student grades for the first nine weeks period (October 1993).

For the second nine weeks grading period (January 1994) eight teachers (50%) turned in computer generated lesson plans and eight teachers (50%) turned in printouts of student grades. The number of teachers responding to the request for the second nine weeks grading period approximates the number of teachers (seven) who had reached the Routine (IVA) level of use for microcomputer technology by December 1993.

Eight teachers (50%) turned in computer generated lesson plans and computer printouts of students' grades for the third nine weeks grading period (March 1994). As can be seen in Table 14, these data support Level of Use interview data in that users of an innovation normally move

Table 14

Percent of Teachers Generating Computer Lesson Plans and Student Grade Reports Per Nine Week Period, 1993-1994

	Nine Week Period			
	1st	2nd	3rd	4th
Lesson Plans	25%	50%	50%	56%
Grade Reports	44%	50%	50%	75%

Note: N=16

to Level IVA and stabilize their use of a particular innovation. (By May 1994, eight teachers (50%) were at Level IVA.)

For the fourth nine weeks grading period (June 1994) nine teachers (56%) turned in computer generated lesson plans and twelve teachers (76%) turned in computer printouts of students' grades. This number is the same as the number of teachers at the Routine level of use or above. From the first nine weeks grading period to the fourth nine weeks grading period there was an increase in the number of teachers turning in lesson plans and printouts of students' grades which indicated an increase in the use of microcomputer technology by teachers and movement on the continuum of Level of Use. Table 14 summarizes the percent of teachers turning in lesson plans and student grade reports for the 1993-1994 school year.

The pictures in Figures 13 and 14 show teachers using microcomputer technology to produce lesson plans and to printout student grade reports. The pictures are representative of teachers using microcomputer technology and provides another source of evidence to support the researcher's conclusions.

It is clear from the LoU data collected through the focused interview with teachers that the NHJ experience with microcomputer technology were consistent with the research findings of Hord et al. (1987). One, at NHJ there was sequential movement of teachers from the nonuser levels to user levels. There were no teachers at NHJ at Level 0 (nonuse) at either administration. This level is described as the condition in which the individual has little or no knowledge of the innovation and is doing nothing toward becoming involved.

From the first administration of the LoU focused interview to the second administration, four teachers moved to a higher level of use. Two teachers moved from Level III (Mechanical) to Level IVA (Routine). One teacher moved from Level I (Orientation) to Level II (Preparation). And one teacher moved from Level IVA (Routine) to Level IVB (Refinement).

Figure 13. Teacher using Lesson Planner program, February 1994

Figure 14. Teacher using Gradebook Plus to record students' grades, March 1994

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The majority of teachers using microcomputer technology reached Level IVA and stabilized. For both administrations, the majority of teachers clustered at the Mechanical (Level III) and the Routine Levels (Level IVA).

A comparison of data obtained from the first and second administrations of Level of Use interviews indicated that the innovation had diffused and was being practiced in the school environment.

Level of Use results indicated that more than 80% of the teachers were users of microcomputer technology during the 1993-1994 school year. This percentage reveals the level of diffusion and practice of microcomputer technology by teachers.

Teachers and Microcomputer Technology

Two types of interview were used in the study (a) open-ended and (b) focused. The focused interview was used to gather data with the CBAM Level of Use protocol. Merriam (1988) noted that the interview is needed when researchers are unable to observe feelings, behavior, or how people interpret the world around them. The open-ended interview was used to gain further insight into the feelings of the participants about the microcomputer workstation and to corroborate such feelings among participants.

The expected result of the association of teachers and microcomputer technology was that teachers would become proficient users. The innovation configuration of a microcomputer workstation at NHJ required teachers to use the microcomputer and two software programs to become familiar with the capabilities of microcomputers to enhance teachers' productivity. The consistency of use and familiarization of teachers with both programs and positive attitude toward microcomputer technology would denote successful innovation diffusion and practice.

Teachers were interviewed several times during the 1993-1994 school year to link data collected using other instruments. Two specific interview times were used. These times were January 1994 and May 1994.

In January 1994, nine teachers were selected and were asked several questions pertaining to microcomputer technology. The questions and teacher responses are given below:

1. Do you have a feeling of increased professionalism as a result of using microcomputer technology?

Teacher comments relative to this question were, "I feel more confident in what I can do with computer technology," "I can boast to someone else," "Yes, It

makes my job a little easier," "Printing out a student's individual grades in front of a parent is certainly more professional than covering grades of other students with a piece of paper," and "Yes, I am able to share with others."

2. Since becoming a user of microcomputer technology, has your professional productivity increased, decreased, or remained the same?

Affirmative responses were also given by teachers to question two. Teacher responses were, "Increased to all of the above," "Increased, I feel more confident," "The more I use it my professionalism increases," "Increased, saves time," and "Increased."

3. Please describe the impact of microcomputer technology upon you as a teacher.

Teachers responded, "It is a quicker and easier way of doing grades and lesson plans," "I've gained more knowledge and my productivity has improved," "Great, it's a time saver," "At first I was afraid, thinking it would interfere with other things. It has made things so much more convenient," "I feel better about myself," and "It saves me time."

In May 1994, classroom teachers were again interviewed and asked key questions about microcomputer technology.

These questions were focused toward a retrospective look at where teachers had come from in the use of microcomputer technology since teachers were now near the close of the year and data collection for the study was coming to an end. The following are questions and answers of teachers concerning microcomputer technology:

1. Has microcomputer technology facilitated more sharing and communication among colleagues?

Teacher responses to this question were: "Yes," "I think so, and they would like to do more," "Yes, I think so," "Yes, within the grade level," and "It (microcomputer technology) really forged a bond between us."

2. Please describe the key driving force or impetus that propelled you toward being a user of microcomputer technology.

Teacher responses to this question were: "Curiosity" "Other teachers using it (microcomputer technology)," "Colleagues, people around me were doing it," "Peer pressure, jumping on the bandwagon with everyone else," "It's indispensable, I have one at home and one at work."

3. Please describe the key driving force or impetus that propelled your colleagues toward being users of computer

technology.

In response to this question teachers responded: "Availability of the computer, "The opportunity was there to take advantage of," "Seeing other teachers use it. It became the thing to do." "It's a better way. It's better than the traditional way," and "Other teachers were role models."

Summary

Data obtained from each administration of the Stages of Concern instrument alerted the change facilitator to the concerns teachers had about microcomputer technology. The change facilitator applied the interventions of the change facilitator strategy to the SOCQ identified area of teacher need. The combination of knowing the area of assistance of teachers identified in the highest and second highest concern scores and the ability to address the needs through intervention assisted the change process for teachers. Interventions like providing workshops to increase teachers' understanding of microcomputer technology, talking one-to-one with teachers about time savings, reduction of paper work, and ease of use of microcomputer technology, and permitting teachers to take the microcomputer workstation home contributed to teacher use of microcomputer technology

and provided an impetus for teachers to move through the Self concern stages toward the Task and Impact stages of concern.

Level of Use data were collected twice during the 1993-1994 school year. These data identified the level at which teachers were actually using the innovation configured as microcomputer workstation. At the beginning of the 1993-1994 school year, all classroom teachers were basically nonusers of the innovation. During the course of the year, teacher use of microcomputer technology was facilitated using the NHJ Change Strategy. By the end of the school year, 80% of classroom teachers had reached the Routine (IVA) Level of Use. The Level of Use interview data were supported both by researcher observation of teachers' use of microcomputer technology and microcomputer generated teacher printouts of lesson plans and student grade reports.

Open-ended interviews with teachers were used to collect additional data about the impact of microcomputer technology on teachers. These interviews yielded data beyond that collected with the CBAM instruments. In the open-ended interviews, teachers described their feelings and the impact of microcomputer technology upon them as professionals. Teachers' gave positive responses to questions about the

impact of microcomputer technology upon them. In general, teachers believed that microcomputer technology enhanced their professional skills.

CHAPTER 7

FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

The purpose of this study was to examine the initiation and implementation of microcomputer technology in N. H. Jones Elementary School and to assess its impact on teachers. The study also focused on the change process which was an accompanying phenomenon of introducing microcomputer technology into the organization.

A model for planning, diffusing, and implementing microcomputer technology was developed. Key elements of that model included guidelines of the Innovation-Focused strategy that Fullan (1985) developed out of the literature. Five guidelines were used to advance the innovation at NHJ. The first guideline, planning, was accomplished primarily through the work of Chapter 1 committee meetings in March 1992 and the ITPC meetings in the summer of 1992. The second guideline, development and clarification of central office role, was established with the need to have funds to purchase materials, supplies, equipment, and provide staff development. The Chapter 1 office served this purpose. The

third Guideline was identification and selection of the innovation. Instructional technology (defined as one or more instructional devices) was identified as the innovation by the original Chapter 1 planning committee in the 1990-1991 school year. The fourth guideline was clarification of the role of the principal and establishment of school processes. The school principal had an interest in enhancing teachers' skills through microcomputers. Other processes like supporting a technology initiative, providing assistance, and software decisions were accomplished in ITPC meetings. The fifth guideline stressed the need for staff development and technical assistance. The ITPC decided that its members would serve teachers' need for assistance with technology.

Another key element in the model were interventions of the Change Facilitator strategy (Hall & Hord, 1984). Interventions of this strategy were used to foster the acceptance and use of microcomputer technology and assist in its implementation in the school. The interventions of four game plan components of the strategy were used in the study. These interventions were prominent throughout the study because they specified what the change facilitator could do to promote innovation adoption and support the change process. Workshops to increase teachers' knowledge of the

innovation and provide opportunity for them to interact with microcomputer technology were important interventions. Other interventions included events to develop positive attitudes, celebrate small successes, and assist teachers in solving problems. Each intervention contributed to teachers' adoption of microcomputer technology configured as a teacher workstation.

The Concerns-Based Adoption Model (CBAM) was also a major element in the change model. Its three dimensions, Innovation Configuration, Stages of Concern, and Levels of Use provided the means for monitoring and interpreting the impact of microcomputer technology on teachers at NHJ. Configuring the innovation identified the components of microcomputer technology and specified exactly what teachers were expected to do. The Stages of Concern dimension identified concerns teachers had about microcomputer technology and alerted the change facilitator to specific interventions to assist individual teachers. And the Level of Use dimension identified the extent to which teachers were using microcomputer technology.

Findings

Five research questions were defined to give focus to the inquiry. Answers to those questions were derived from

prolonged engagement at the case site (2 years) and data collected from the participants using various instruments. Many of the findings of this study are consistent with findings in the research literature on use of microcomputers and the change process. There are findings from this study that arose from the context of the NHJ school environment and the interaction of the teachers with microcomputer technology. These findings will be discussed in relation to the research question to which they apply.

Research Question 1: What concerns did teachers have about microcomputer technology?

The CBAM Stages of Concern instrument informed that teachers had concerns about microcomputer technology in the areas Self, Task, and Impact. At the beginning of the study teachers had intense concerns in the area of self. These concerns were awareness of the innovation (microcomputer technology), information about microcomputer technology, and personal concerns like, teachers perception of status, rewards, and wellbeing in relation to microcomputer technology. Teachers in the Task stage were concerned about logistics and time to implement the innovation. And teachers with Impact concerns were asking questions of impact on clients,

how to collaborate with colleagues, and they believed there was a better way to improve their productivity.

Research Question 2: Were there factors in the school environment that promoted the diffusion and use of microcomputer technology by teachers?

Researchers (Bitter and Yohe, 1989; Carlson, 1989; Fullan, 1985; Fulton, 1989; Hord et al., 1987; Perelman, 1987; Sandholtz & Ringstaff, 1993; Stakenas et al., 1992; & Van Horn, 1990) have identifed a list of factors that are recognized as promoters of technology in schools. That list included teacher training, access to technology, time to practice with the innovation, a cadre of teacher experts, funds to acquire technology, involvement of teachers in decision making, administrative support, key personnel to coordinate the technology initiative and technical assistance. Consistent with findings of these researchers, teachers at NHJ reported access to technology, colleague assistance, time to practice with the innovation, ease of use of the innovation, a nonpunitive school environment that encouraged teachers to experiment with technology, and training to use the technology as factors that promoted adoption.

Research Question 3: Were there perceived barriers that impeded acceptance and use of microcomputer technology by teachers?

Over the course of the study there were a number of obstacles that had to be overcome. Teachers were given a survey to ascertain from their perspective the barriers to microcomputer technology at NHJ. Teachers listed lack of training, limited access to hardware, lack of interest by teachers, fear of failure, lack of knowledge about integrating technology into the curriculum, teachers already burdened with many things to do, and fear of the innovation as barriers to acceptance and use. Each of the barriers identified by teachers posed a threat to successful implementation.

In addition, there were other barriers to the technology process at NHJ. Some of the more noteworthy hurdles were deciding upon whether to mandate or not mandate use of technology, delayed delivery of microcomputers, less than 100% commitment by teachers, risks related to redefining the innovation, and the loss of 50% of the ITPC members at the beginning of the 1993-1994 school year.

Research Question 4: What levels of use did teachers attain with the innovation microcomputer technology?

The CBAM Level of Use instrument identified the user state of teachers at NHJ. There was a continuum that could be identified with teachers and microcomputer technology at NHJ. Teachers could be placed on that continuum from nonuser to user. By the end of the 1993-1994 school year 80% of the teachers had reached user status. Fifty percent of those teachers had reached the Routine user level (IVA) and had stabilized their practice with microcomputer technology. Hard copies of teacher lesson plans and printouts of student grade reports supported the level of use interview data.

Research Question 5: What teacher-related outcomes are attributed to using microcomputer technology?

As teachers used microcomputer technology as a productivity tool, they realized the positive benefits of time saved, reduced paperwork, easier accomplishment of repetitive tasks, and increased self-esteem. Teachers developed positive attitudes about using microcomputer technology and gained confidence in their ability to use a microcomputer workstation. According to teachers, technology saved time thereby allowing them to spend more time assisting students. Teachers using microcomputer technology were able to produce lesson plans and printouts of students' grades, and word process. More than 80% of teachers were

able to use microcomputer technology at an acceptable level. Observation of teachers revealed that teacher collaboration increased as they sought technical assistance about microcomputer technology.

Conclusions

The conclusions of the study emerged from the research findings. Study conclusions are presented in relationship to the research findings. Some of the conclusions can be generalized to the field of practice while others are specific to NHJ.

Based on the findings of Research Question 1 it was concluded that teachers had concerns about microcomputer technology and those concerns changed over time. As teachers became familiar with microcomputer technology through practice, they gained confidence in their ability to use it. Teachers' concerns moved from being intense in the Self concern stages to concerns in the Impact stages. This indicated that concerns in the Self concern stages were sufficiently resolved enabling teachers to move toward Impact stages of concern. The observed intensity of Impact concerns was related to increased use of microcomputer technology.

Teachers' concerns about an innovation can be reduced

with a strategy that understands, accepts, and works within the parameters of their point of view. Self concerns of teachers can be overcome when appropriate interventions are applied to teachers' areas of concern. Application of interventions specific to a teacher's concerns about the innovation alleviates the concern. The interventions of the change facilitator strategy helped teachers to use microcomputer technology and increased their confidence in their ability to use microcomputer technology.

Based on the findings of Research Question 2 it was concluded that there were factors in the school environment that promoted the diffusion and use of microcomputer technology by teachers. The Chapter 1 Schoolwide project was an essential element in the technology process and provided the funds to acquire hardware, software and peripherals for the workstation configuration. Teachers' access to the innovation was increased because a sufficient quantity of workstations were purchased. Chapter 1 funds used to pay for substitute teachers gave NHJ teachers time to practice with microcomputer technology. Teachers acting as resource persons for other teachers promoted diffusion and use of microcomputer technology.

Teachers are a motivating presence and force for other

teachers in a school. At NHJ, teachers who were users of microcomputer technology were a driving force for other teachers who were attempting to become microcomputer technology users. As role models, these teachers helped their colleagues overcome awareness, informational, and management concerns and propelled colleagues from nonuse to user levels of microcomputer technology. Colleague assistance is an important element in the school environment and promoted the diffusion and use of microcomputer technology by teachers. Teacher isolation epitomized in practicing the innovation behind closed doors, diminished as teachers sought assistance and support from colleagues in using microcomputer technology. Teachers who had advanced in their understanding of using the innovation were willing to use their acquired knowledge to assist other teachers to increase their proficiency. The innovation opened doors and lines of communication between teachers to share their acquired expertise and experiences with microcomputer technology (Sandholtz & Ringstaff, 1993; Ray, 1991).

Consistent with a conclusion reached by Gillman (1989), a supportive nonpunitive environment and no pressure on teachers to become users of microcomputer technology promoted teachers use of microcomputer technology at NHJ.

The efficacy of the decision to not pressure teachers was evidenced in the percent of teachers reaching Levels of Use III, IVA, and IVB (80%) with microcomputer technology by May 1994. Classroom teachers were unanimous in their response of not feeling pressured during the process of change and use of microcomputer technology. Results of the research project indicated that utilizing an approach that empowers teachers to use an innovation rather than mandating teacher use fosters a positive attitude for acceptance and diffusion of the innovation. Administrative support in the form of technical assistance, encouragement and praise, furnishing materials, supplies, and equipment promoted the change process and the diffusion of microcomputer technology.

Based on the findings of Research Question 3 it was concluded that <u>there were barriers in the school environment that impeded teachers' acceptance and use of microcomputer technology</u>. In this case, lack of prior training opportunities with technology, lack of access, teachers' fear of failure in operationalizing the innovation, lack of interest by teachers in the innovation, and teachers already consumed with daily tasks and responsibilities were recognized as barriers to acceptance and use of microcomputer technology. Lack of training opportunities can

increase teachers' fears and serve to further knowledge acquisition and experience using microcomputers. This barrier can be overcome by providing inservice training for teachers based upon their specific needs and level of expertise rather than blanket inservice for all teachers (field notes, Dos 1, p. 22, VCR recording A, 1992; Stakenas et al., 1992).

Lack of teacher access to all components of the innovation is a significant barrier in successful adoption and implementation. A determinant of the success of microcomputer technology is the extent to which provisions are made to provide all users and potential users with the components of the innovation. An insight that emerged from the experience at NHJ was that it does little good to have an abundance of microcomputer technology but have few individuals who can use them. Likewise, it is as frustrating to have an abundance of individuals with expertise/motivation to use microcomputer technology but not have the devices available to use.

Early identification of barriers to implementation and use is essential for successful adoption. As organizational barriers were addressed at NHJ, the magnitude of individual barriers decreased and the potential for successful

implementation and use of the innovation was enhanced.

Based on the findings of Research Question 4 it was concluded that teacher commitment to use microcomputer technology increases as more time is spent with the innovation. N. H. Jones teachers viewed microcomputer technology as an advantage over the traditional teacher method of doing lesson plans and recording student grades. Using microcomputer technology to accomplish the task of writing lesson plans and maintaining students' grades replaced the traditional handwritten method. As teachers' concerns diminished in the Self concern stages they increased in the Impact stages and teachers reached higher levels of use with microcomputer technology.

Based on the findings of Research Question 5 it was concluded that teachers developed a feeling of professionalism as a result of using microcomputer technology. Interview data indicated that teachers believed their professionalism and their self-esteem increased because of their knowledge about and their ability to use microcomputer technology. Using microcomputer technology saved time for teachers and allowed them to spend more quality time in substantive activities with students.

There were other conclusions that arose out of the NHJ

microcomputer technology experience. The first such conclusion is that there is no one best way to introduce microcomputer technology in schools. There are strategies in the literature in addition to the Innovation-Focused strategy (Fullan, 1985), the Change Facilitator strategy (Hall & Hord, 1984), and the Concerns-Based Adoption Model (Hord et a., 1987) that can facilitate introduction of microcomputer technology into an organization. This study showed that an empowered group of teachers allowed to utilize their expertise can positively influence innovation adoption. Teachers guided by a vision of what an innovation can accomplish and drawn to collaboration and administrative support can work toward institutionalizing an innovation in the organization.

Using an appropriate change strategy with teachers facilitated their acceptance and use of microcomputer technology. Teachers were empowered from the beginning of the change process. They were involved in decision making which elevated their status to one of leadership. Teachers' expertise was utilized which indicated value for their thoughts and ideas. Teachers were not pressured to use the innovation but were praised when they attempted use.

Teachers need to know that administration cared about

the innovation and its effect on them and the school. In the change process the supportive role that the change facilitator assumed was a catalyst in teachers adopting and implementing microcomputer technology.

Configuring the innovation into its component parts (teacher workstation) informed the principal as change facilitator if teachers were lacking components necessary for successful implementation of microcomputer technology. Configuring the innovation into its component parts specified exactly what was to be done with the innovation by its users. And configuring the innovation assisted the change facilitator in determining if the critical variables for successful implementation of the innovation were present. It allowed the principal as change facilitator to recognize acceptable and unacceptable use of microcomputer technology by teachers.

The complexity of the innovation has an effect on the rate in which teachers mastered and practiced the innovation (Bauchner, Eiseman, Cox, & Schmidt, 1982). The more specific the innovation combined with ease of operation contributed to teachers' feeling of confidence that they could operationalize the innovation in the environment. In the 1992-1993 school year the innovation was configured as

several instructional technology devices and teachers chose one or more devices to become expert in using. Teachers' access to the range of devices was limited and progress in adopting and using the selected devices was restrained. The range of devices created ambiguity in exactly what teachers were to do with the instructional technologies. The innovation was configured as a teacher workstation with eight component parts for the 1993-1994 school year. This configuration identified exactly what teachers were to do and adoption and use proceeded at a rapid pace. The reconfigured innovation was easier to implement and monitor in comparison to the several devices that composed the initial instructional technology innovation.

Ensuring teachers' access to microcomputers and appropriate software for the technology initiative (Sheingold & Hadley, 1990) was an important element in the success of innovation implementation. The establishment of a system where teachers checked out microcomputers from school and used them at home permitted opportunity for them to practice and use microcomputer technology and increased access. Weekends, holidays, and week days were all times that teachers could use to further their knowledge and professional skills in using microcomputers (field notes,

Dos 1, p. 60, VCR recording B, 1992).

Training teachers to use microcomputer technology should be viewed as a prerequisite to successful implementation. Teachers need time to practice with microcomputer technology to overcome fear of failure. By familiarizing themselves with the capabilities of technology, they acquire the skills to implement microcomputer technology. Training cannot be overlooked (Boe, 1989) or made secondary when preparing teachers to become users of microcomputer technology. When training is made a primary focus of the change effort, access to technology, time to practice with the technology, and opportunity for colleague assistance intermingle to produce impetus for adopting the innovation. Where possible, release time (Naron & Estes, 1985) for teachers needs to be an integral part of the microcomputer technology initiative. Important to the success of the microcomputer technology initiative is time for teachers to master its capabilities.

This study underscored the change process and diffusion of an innovation as occurring over time. It was found that progress could be made toward diffusing an innovation in the span of a year and for that innovation to be practiced at an acceptable degree. Study results bear out previous research

and ITPC discussions that change is a process and does not happen instantly. A retrospective look at the change process and microcomputer technology at NHJ suggests that starting with a simple configuration before going to a more complicated configuration has merit and is related to the rate of acceptance of an innovation.

A key to the success of a technology effort is the recognition that an innovation appropriately configured for the specified task has a greater chance of saturation in an organization in a one year period of time than a complex innovation has in the same length of time. Bauchner, Eiseman, Cox, and Schmidt (1982) reported that data on the dynamics of implementation depends upon the amount of change that teachers are expected to make and outcomes are more predictable when the magnitude of change is moderate or low.

By the end of the project, teachers at NHJ accepted and became users of microcomputer technology. After a year of using microcomputer technology and two software programs, configured as a teacher workstation, teachers indicated a desire to move beyond those confines to explore a broader realm of possibilities brought about by their experiences with microcomputer technology. This suggests that teacher success in using microcomputer technology generates

motivation to continue learning more about microcomputer technology.

Once teachers become users of microcomputer technology the need to maintain a level of assistance becomes mandatory (Sheingold, 1993). Provisions need to be made in the organization to supply technical assistance to teachers to overcome fear of using technology and maintain productivity with microcomputers. Invariably problems arise for users of microcomputer systems. Without technical assistance teachers will not be able to maintain their level of productivity in using microcomputer technology and may become frustrated in the process.

Recommendations

There are many possibilities for using instructional technology in schools to affect instructional outcomes. Appropriate configurations of interactive multimedia, distance learning, computer-managed instruction and computer-assisted instruction in schools are yet to be determined and used, and their impact assessed. A recommendation for further research is to study various configurations of instructional technology that reach beyond the teacher workstation and include various and more complex applications.

Given that no best way for introducing microcomputer technology into the fabric of schools has been found, efforts focused on outlining models to introduce technology in schools and accompanying strategies to initiate technology are still needed. This study emphasized the central role of teachers and the change facilitator in the technology effort. Continued research on implementation strategies may uncover increased roles for administrators, central office staff, and other facilitators that will contribute to the successful implementation and institutionalization of innovation in schools.

While a strategy was found that facilitated the acceptance, diffusion, and implementation of microcomputer technology into the NHJ environment, there is a need to replicate the study to determine if the model for initiation and implementation can be successfully introduced in other schools to obtain similiar results.

The scope of this research project was limited to five research questions that focused on the initiation and implementation of microcomputer technology configured as a teacher workstation and its impact on teachers. There is a need to expand the research questions to understand more about the change process and in particular innovations and

teachers. Microcomputer technology brought teachers out of isolation at NHJ. What is the long term effect of teacher collaboration with technology? How does this effort impact teacher relationships? After a year of interacting with microcomputer technology, teachers evidenced a desire to expand beyond the innovation configured as a teacher workstation. What effect does success in using microcomputer technology have on teacher professional development and their desire to extend their knowledge? This study found that teachers progressed from nonuser levels of use to user levels of use in a short time (1 year). Further research is needed to determine long term impact of microcomputer technology configured as a workstation. Additionally, long term impact of other configurations of instructional technology on teachers remains to be done.

Appendix A

Stages of Concern Technical Information

The manual Measuring Stages of Concern About The Innovation Hall et al., (1986) reported the reliability of the Stages of Concern Questionnaire (SOCQ) detailing the validation study which used a population of 830 teachers to obtain coefficients of internal reliability for each Stage of Concern. The coefficients respectively are .64, .78, .83, .75, .76, .82, and .71 (Hall et al., 1986). Test-retest correlations on a population of 132 respondents yielded coefficients of .65, for the Awareness stage, .86 for the Informational stage, .82 for the Management stage, .81 for the Consequence stage, .76 for the Collaboration stage and .71 for the Refocusing stage (Hall et al., 1986).

Appendix B

N. H. Jones Elementary Change Strategy

Innovation-Focused Strategy	Change Facilitator Strategy	N. H. Jones Change Strategy
1) Develop a Plan 2) Clarify and develop the role of the central staff 3) Select innovations and schools 4) Clarify and develop the role of principals and criteria for school-based processes 5) Stress staff development and technical assistance	GPC 1: Developing Supportive Organizational Arrangements developing innovation-related policies establishing global rules, making decisions, planning, preparing, scheduling, staffing, restructuring roles, seeking or providing materials, providing space, seeking/acquiring funds, providing equipment	1) Develop a plan 2) Clarify and develop the role of central office 3) Select innovations and schools 4) Clarify and develop the role of principal and criteria for school-based processes 5) Stress staff development and technical assistance GPC 1: Making decisions Planning Preparing Seeking or providing equipment
4) Clarify and develop the role of principals and criteria for school-based processess 5) Stress staff development and technical assistance 6) Ensure information gathering and use	GPC 2: Training developing positive attitudes increasing knowledge, teaching, innovation-related skills, reviewing information, holding work-shops modeling/demonstrating innovation use, observing innovation use, providing feedback on innovation use, clarifying innovation misconception	GPC 2: Training developing positive attitudes increasing knowledge, teaching, innovation-related skills, reviewing information, holding work-shops modeling/demonstrating innovation use, observing innovation use, providing feedback on innovation use, clarifying innovation misconception
	GPC 3: Consultation and Reinforcement encouraging people one-to-one, promoting innovation use among small groups, assisting individuals in solving problems, coaching small groups in innovation use, sharing tips informally, providing personalized technical assistance, holding brief conversations and applauding progress, facilitating small groups	GPC 3: Consultation and Reinforcement encouraging people one-to-one, promoting innovation use among small groups, assisting individuals in solving problems, coaching small groups in innovation use, sharing tips informally, providing personalized technical assistance, holding brief conversations and applauding progress, facilitating small groups
6) Ensure information gathering and use 7) Plan for continuation and spread 8) Review capacity for future change	GPC 4: Monitoring gathering information collecting data assessing innovation use or concerns formally, analyzing/processing data, interpreting information, reporting/sharing data on outcomes, providing feedback on information collected, administering end-of workshop questionnaire, conferencing with teachers about progress in innovation use	GPC 4: Monitoring gathering information collecting data assessing innovation use or concerns formally, analyzing/processing data, interpreting information, reporting/sharing data on outcomes, providing feedback on information collected, administering end-of workshop questionnaire, conferencing with teachers about progress in innovation use

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Appendix C

Level of Use Protocol

LoU Interview

O-II/III-VI	Are you currently using _____? If yes, turn page. If no, continue. NO
	Have you ever used it in the past? If so, when? Why did you stop?
	If yes, go to PAST USERS (Below)_____ If no, continue.
O/I-II	Have you made a decision to use _____ in the future?
I-II	If so, when will you begin use?
Knowledge	Can you describe_____for me as you see it?
Acquiring information	Are you currently looking for any information about information _____? What kinds? For what purposes?
Knowledge	What do you see as the strengths and weaknesses of _____ in your situation?
Assessing	At this point in time, what kinds of questions are you asking about_____? Give examples if necessary.
Sharing	Do you ever talk with others and share information about _____? What do you share?
Planning	What are you planning with respect to _____? Can you tell me about any

preparation or plans you have been making for the use of _____?

Final Question Can you summarize for me where you see yourself right now in relation to the use of _____?

PAST USERS

Can you describe for me how you organized you use of _._____, what problems you found, what its effects appeared to be on students?

When you assess _____ at this point in time, what do you see as the strengths and weaknesses?

NOW, GO TO ABOVE SECTION, STARTING WITH QUESTION MARKED I/I-II.

YES

Open-ended Please describe for me how you use _____. (Ask sufficient questions to cover minimal criteria for use.)

Assessing/ Knowledge What do you see as the strengths and weakness of _____ in your situation? (Have you made any attempt to do anything about weaknesses? Probe those they mentioned specifically.)

Acquiring Are you currently looking for any information information about _____ What kind? For what purposes?

LoU V Do you work with others in your use of_____? Do you meet on a regular basis? Have you made any changes in your use of _____based on this coordination?

If yes, go to LoU V Probes (Below)

Sharing Do you ever talk with others about _____? What do you tell them?

Assessing (Have you considered any alternatives or different ways of doing this with the

program?) Are you doing any evaluating, either formally or informally, that would affect your use of _____? Have you received any feedback from students that would affect the way you're using _____? What have you done with the information you got?

III/IVA/IVB Have you made any change recently in how you use _____? What? Why? How recently? Are you considering making any changes?

Planning/Status As you look ahead to later this year, what plans do you have in relation to your use of _____?

III-V/VI Are you considering or planning to make major modifications or replace _____at this time?

LoU V Probes

1. Please describe for me how you work together. (What things do you share with each other?)
2. What do you see as the effects of this collaboration?
3. Are you looking for any particular kind of information in relation to this collaboration?
4. Do you talk with others about your collaboration? If so, what do you share with them?
5. Have you done any formal or informal evaluation of how your collaboration is working?
6. What plans do you have for this effort in the future?

If you have enough evidence to place the person at an LoU V, go to Question III-V/VI.

If you do not think the person is an LoU V, go to Question Sharing.

Appendix D

Table 15

Chronology of Events

Month	School Year 1991-1992	1992-1993	1993-1994
August		NHJ technology plan is launched.	Initial microcomputer technology workshop. Teachers receive computer workstations.
September		Teachers choose instructional technology for 1992-1993. Instructional technology distributed to teachers.	Second computer technology workshop. SOCQ instrument given to teachers.
October			
November			EMG workshop for teachers. Change facilitator receives CBAM training.
December		Chapter 1 equipment and materials ordered in April 1992 arrive at NHJ.	First LoU interviews conducted with teachers.
January			NHJ teachers visit Webster technology school. EMG workshop for teachers.
February		SOCQ pilot study with teachers.	IBM computer lab inservice for teachers. Multimedia inservice for teachers.
March	Chapter 1 planning committee recommends equipment, materials, and supplies for purchase.	NHJ technology innovation redefined.	
April		Macintosh computers and printers ordered in April 1992 arrive at NHJ. WordPerfect software and GradeBook Plus software ordered.	
May	Formation of the NHJ ITPC.	Teachers complete surveys assessing factors promoting technology, barriers to implementing technology, and evaluating the NHJ technology initiative. NHJ Lesson Planner program development begins.	Second administration of the SOCQ and LoU CBAM instruments. NHJ "Technobash."
June	First and second meeting of the NHJ ITPC.		End of study.
July	Third meeting of the NHJ ITPC.	Microcomputer technology workstations assembled and prepared for the 1993-1994 school year. New teacher interviews conducted.	

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Appendix E

Microcomputer Workstation Configuration

Teachers have innovation components 1-5 and are using components 6 & 7	Teachers have components 1-5 but do not use components 6 & 7	Teachers do not have components 1-5 and cannot use components 6 & 7
*Component 1: Hardware 1. Macintosh computer w/printer 40 meg HD, IBM computer w/printer & 20 meg HD, surge protectors, and electrical cords	*Component 1: Hardware 2. Macintosh computer w/printer 40 meg HD, IBM computer w/printer & 20 meg HD, surge protectors, and electrical cords	*Component 1: Hardware 3. Macintosh computer w/printer 40 meg HD, IBM computer w/printer & 20 meg HD, surge protectors, and electrical cords
*Component 2: Software 1. WordPerfect 2.1 for Macintosh WordPerfect 5.1 for IBm Gradebook Plus for Macintosh Gradebook Plus for IBM Lesson Planner Program for Macintosh & IBM	*Component 2: Software 2. WordPerfect 2.1 for Macintosh WordPerfect 5.1 for IBm Gradebook Plus for Macintosh Gradebook Plus for IBM Lesson Planner Program for Macintosh & IBM	*Component 2: Software 3. WordPerfect 2.1 for Macintosh WordPerfect 5.1 for IBm Gradebook Plus for Macintosh Gradebook Plus for IBM Lesson Planner Program for Macintosh & IBM
Component 3: Computer carts 1. Bretford computer carts	Component 3: Computer carts 2. Bretford computer carts	Component 3: Computer carts 3. Bretford computer carts
*Component 4: Training 1. Inservices for teachers to use Macintosh and IBM WordPerfect programs, Gradebook Plus and Lesson Planner program.	*Component 4: Training 2. Inservices for teachers to use Macintosh and IBM WordPerfect programs, Gradebook Plus and Lesson Planner program.	*Component 4: Training 3. Inservices for teachers to use Macintosh and IBM WordPerfect programs, Gradebook Plus and Lesson Planner program.
Component 5: Computer disks 1. 1 box of formatted computer disks for teachers using the innovation	Component 5: Computer disks 2. 1 box of formatted computer disks for teachers using the innovation	Component 5: Computer disks 3. 1 box of formatted computer disks for teachers using the innovation
*Component 6: Using Gradebook Plus Macintosh and IBM versions 1. Teacher uses Gradebook Plus to a) record grades, b) create a class list, c) generate letters, d) generate student grade report, e) average grades, and track student assignments.	2. Teachers do not use component 6	3. Teachers cannot use component 6.
*Component 7: Using Lesson Planner program 1. Teacher uses Lesson Planner program to develop daily lesson plans.	2. Teachers do not use component 7	3. Teachers cannot use component 7.
*Component 8: Assistance 1. Teacher receives assistance beyond initial training to use microcomputer technology, (i.e. Gradebook Plus and Lesson Planner).	2. Teachers do not request assistance.	3. Teachers have no need for component 8.

*Denotes Critical Component _____ Variations to the right are unacceptable --------- Variations to left are acceptable

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Appendix F

Stages of Concern Interpretations

0 AWARENESS: Little concern about or involvement with the innovation is indicated.

1 INFORMATIONAL: A general awareness of the innovation and interest in learning more detail about it is indicated. The person seems to be worried about herself/himself in relation to the innovation. She/he is interested in substantive aspects of the innovation in a selfless manner such as general characteristic, effects, and requirements for use.

2 PERSONAL: Individual is uncertain about the demands of the innovation, her/his inadequacy to meet those demands, and her/his role in relation to the reward structure of the organization, decision, making and consideration of potential conflicts with existing implications of the program for self and colleagues may also be reflected.

3 MANAGEMENT: Attention is focused on the processes and tasks of using the innovation and the best use of information and resources. Issues related to efficiency, organizing, managing, scheduling, and time demands are utmost.

4 CONSEQUENCE: Attention focuses on impact of the innovation on students in her/his immediate sphere of influence. The focus is on relevance of the innovation for students, evaluation of student outcomes, including performance and competencies, and changes needed to increase student outcomes.

5 COLLABORATION: The focus is on coordination and cooperation with others regarding use of the innovation.

6 REFOCUSING: The focus is on exploration of more universal benefits from the innovation, including the

possibility of major changes or replacement with more powerful alternative. Individual has definite ideas about alternatives to the proposed or existing form of the innovation.

Analysis

The simplest form of interpretation is to identify the highest stage score (Peak Stage Score). A more detailed interpretation is developed by examining both high stage score and the second highest score. This analysis is based on description of the subjects first and second highest stage scores. Interpretations must be treated as hypothesis that will be confirmed by the subjects themselves.

PEAK SCORE INTERPRETATIONS

Peak Score is represented by (H)

Stage 0

Stage 0 has two different meanings depending upon whether the respondent is a user of the innovation or a nonuser of the innovation. For the user, a high Stage 0 score indicates an absence of concern about the innovation. For nonusers, a high Stage 0 score indicates awareness of an concern about the innovation.

Usually nonusers who are high on Stage 0 will also be high on Stages 1 and 2.

Users who are high on Stage 0 will be low on Stages 1 and 2.

Stage 1

A high Stage 1 score is indicative of intense concerns about what the innovation is and what use of the innovation entails. Persons who have intense Stage 1 concerns are interested in having more descriptive information about the innovation.

Stage 2

A high Stage 2 score indicates the respondent has ego-oriented questions and uncertainties about the innovation.

Concern about the status, reward, and potential or real effects of the innovation on the respondent are of high concern.

Stage 3

A high
Sstage 3 score is indicative of intense concerns about management, time, and logistical aspects of the innovation.

Stage 4

A high Stage 4 score indicates a concern about the impact of the innovation upon him/her and students.

Stage 5

A high Stage 5 score indicates a concern about working with colleagues and others to coordinate the innovation. This concern is typical of team leaders and administrators who spend a lot of time coordinating with others.

Stage 6

High Stage 6 concerns generally indicate that the respondent has other ideas about the innovation and is concerned about seeing the ideas put into practice or at least tried.

SECOND HIGH SCORE INTERPRETATION

Second High Score is represented by (II)

Generally, the second highest score will be adjacent to the highest stage of concern. Example: If a respondent is high on Stage 3, then he/she will be second highest on Stage 2 or Stage 4. Across a group, however, there are bound to be individuals who do not conform to this general pattern.

The analysis for the second highest score is reasonable straightforward. The second score indicates a concern in that identified stage.

Stages of Concern Questionnaire

The questionnaire was designed for and is intended to be used strictly for diagnostic purposes for personnel involved

in the "adoption" of a process or product innovation. It should not be used for purposes of screening or evaluation. Concerns are neither good nor bad, and it is inappropriate to analyze them in those terms. Knowing that one individual has high Stage 3 concerns and another is high on Stage 4 does not mean that one individual is somehow better than the other. It only means that, in relation to the innovation in practice, the kind of assistance that would be helpful to the two persons is different.

Appendix G

Table 16

Teachers' Stage of Concern Mean Percentile Scores for Instructional Technology, February 1993

Teachers	Stages of Concern 0	1	2	3	4	5	6
Quinn	89	69	70	56	54	11	47
Lewis	72	80	80	47	27	22	42
Jordan	72	60	59	92	76	55	38
Olsen	53	75	59	43	86	68	30
Haynes	84	96	89	65	59	40	57
Adams	53	66	85	39	54	68	69
Olney	91	51	59	27	16	22	42
Vance	81	69	80	69	30	36	38
Ranier	84	98	99	52	92	92	77
Ingram	53	48	52	60	63	59	30
Landis	84	80	80	77	63	36	84
Roberson	89	99	94	69	96	84	60
Arvin	46	84	99	73	96	98	42
Golden	60	90	85	27	71	59	30
Gordon	84	90	78	52	66	52	26
McCoy	96	91	92	88	82	59	60
Hill	53	37	63	43	27	44	34
Means	73	75	78	58	62	53	47

Note: N=17

Appendix H

Table 17

Teachers' Stage of Concern Mean Percentile Scores for Microcomputer Technology, September 1993

Teachers	Stages of Concern 0	1	2	3	4	5	6
Quinn	77	75	94	98	71	88	77
Lewis	84	75	55	52	21	22	52
Jordan	66	84	89	98	33	64	47
Olsen	46	91	59	88	63	52	52
Haynes	86	69	67	43	71	12	30
Oakes	77	88	72	47	66	52	57
Upton	86	84	83	98	9	36	26
Burnes	89	54	83	98	7	36	6
Jeffers	89	60	85	98	13	76	60
Roberson	93	98	89	98	19	84	42
Hughes	72	88	91	85	19	31	52
Reaves	97	98	83	92	82	68	84
Brown	10	96	63	39	66	48	57
Gordon	72	34	28	18	48	25	14
McCoy	86	69	63	60	82	72	77
Hill	89	69	92	65	54	76	38
Means	76	77	74	73	45	52	48

Note: N=16

Appendix I

Table 18

Teacher's Stage of Concern Mean Percentile Scores for Microcomputer Technology, May 1994

Teachers	Stages of Concern 0	1	2	3	4	5	6
Quinn	81	91	92	80	71	48	77
Lewis	77	80	76	34	54	28	20
Jordan	60	60	83	97	43	36	65
Olsen	10	63	78	69	71	84	84
Haynes	81	90	72	60	54	52	94
Oakes	60	95	87	56	76	52	73
Upton	46	37	67	34	33	80	30
Burnes	46	37	48	43	33	88	30
Jeffers	89	63	94	43	92	95	47
Roberson	91	57	94	85	86	93	81
Hughes	29	51	59	56	63	19	73
Reaves	93	93	85	83	48	19	97
Brown	53	54	87	39	63	48	42
Gordon	53	54	45	15	38	55	22
McCoy	89	95	87	65	76	68	73
Hill	53	48	55	15	24	68	17
Means	63	67	76	55	58	58	58

Note: N=16

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